# ANALYSIS OF SINGLE AND MULTI-GRADE LUBRICANT FILM THICKNESS IN A DIESEL ENGINE

by

MARK JOSEPH OLECHOWSKI

B.S. Ocean Engineering, U.S. Naval Academy
(1982)

SUBMITTED TO THE DEPARTMENT OF
OCEAN ENGINEERING
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREES OF

MASTER OF SCIENCE IN NAVAL ARCHITECTURE/MARINE ENGINEERING

and

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
June, 1990

ABSTRACT

ANALYSIS OF SINGLE AND MULTI-GRADE LUBRICANT
FILM THICKNESS IN A DIESEL ENGINE

by
MARK JOSEPH OLECHOWSKI

Submitted to the Department of Ocean Engineering in partial fulfillment of the requirements for the degrees of Master of Science in Naval Architecture/Marine Engineering and Master of Science in Mechanical Engineering.

## ABSTRACT

Several recent experiments have been made to attempt to determine the rheology of the lubricant in journal bearings of engines. A laser fluorescence technique in use at the Massachusetts Institute of Technology allows accurate data collection of the oil film thickness on the ring pack of a production diesel engine. The data collected from the Kubota EA300N IDI engine consisted of five different types of lubricant--two single-grades, two multi-grades, and a synthetic multi-grade.

The data was analyzed and it was found that the lubricant under the compression ring acts in a Newtonian manner independent of lubricant type or inertial effects. The difference between the types of lubricants appears to be the degree to which oil wets the ring--with the single-grade oils wetting the ring more thoroughly than do the multi-grades. A consistent linear relationship between the inlet wetting of the ring and the bearing number (a non-dimensional lift term) was found to exist for each stroke. Drag was also found to be inversely proportional to the amount of inlet wetting.

Thesis Supervisor: Dr. David P. Hoult
Title: Senior Research Associate
Department of Mechanical Engineering

## ACKNOWLEDGEMENTS

I would be unable to submit this thesis without giving credit to those people who encouraged me and provided insight when it was most needed.

. First to thank is Dr. David P. Hoult, my thesis supervisor. He proved to be a very patient man as he watched me struggle through some tough times in the data analysis. He was always available to answer my questions and not let me stray too far out of line. Without his help I would still be bogged down in the tens of data sets that were collected.

The entire staff at the Sloan Automotive Laboratory proved helpful many times. Employed there are many staff members and students to numerous to name. Several persons require special mention. Lt. Matt Bliven, USCG was my office mate for a year and a half. He provided much confidence and common sense advice when things got tough. Jeff Lux and Mark McElwee were the greatest help when I first arrived at the lab. The time they took out of their research to guide me along is much appreciated. Mr. Don Fitzgerald and Brian Corkum were always in the lab ready to lend assistance when required. Finally, Richard Hartman provided help in obtaining last minute data and engine operating conditions.

I am also grateful to Mr. Tayeb Benchaita of the Pennzoil Products Company. His timely analysis of oil samples and constant technical advice is appreciated.

Lastly, I would like to thank my wife, Laraine. She was extremely understanding and provided me with strength and encouragement when it was needed most.

<u>TABLE OF CONTENTS</u>

# CHAPTER 1 - INTRODUCTION

## 1.1 Background

Recently, several experiments have been run in an effort to determine the relationship between lubricant rheology under journal bearings and the performance of these bearings (Spearot et al, Deysarkar, Bates et al). The major conclusion drawn from these works is that there is more to the problem of rheology than the High Temperature / High Shear (HTHS) viscosity relationship. Spearot equates single-grade oils with Newtonian characteristics, whereas the multi-grades he considers to be non-Newtonian. Deysarkar suggests that additional engine and oil parameters need to be introduced in order to fully understand the relationship between oil film thickness and lubricant rheology. It is this relationship to which this data analysis has been directed.

This research presents a lubrication theory which, given that the assumptions and approximations are correct, allows for several conclusions to be drawn about the lubricant rheology and its relationship to film thickness and piston ring friction.

## 1.2 Data Collection

A laser fluoresence technique for determining diesel engine oil film thicknesses has been in use for several years at the Massachusetts Institute of Technology. Billian, Lux and McElwee all showed that the technique can be used to measure film thicknesses on the piston and in the ring pack. McElwee collected data with the technique on five different types of oil -- two single-grades, two multi-grades and a synthetic multi-grade. The data was collected from the Kubota EA300N, a small, single cylinder 0.3 liter indirect-injection diesel engine. For each lubricant tested, 20 different operating conditions were recorded. This collection of data showed that the oil film thickness measurements were accurate and repeatable. McElwee's data is further analyzed within this paper.

## 1.3 Analysis Methodology

McElwee attempted to show that the lubricants used behaved in a Newtonian manner under the piston rings of the Kubota engine. The results of McElwee's work were inconclusive for two major reasons:

1. The lubrication model used was deficient in the specification of boundary conditions.

2. There was a great deal of variability in the film traces from *cycle to cycle.*

The major objective of this research is, therefore, to investigate this variability on a cycle to cycle basis. By examining individual cycle film traces, it is believed that the lubrication model can be modified sufficiently to provide evidence of correlation for all five types of oil -- single and multi-grades.

Analysis of the film trace was carried out in the same manner as in McElwee's work, however, the method was applied to many individual cycles instead of the composite average of one type of stroke in a particular data set. A digitized and scaled ring profile was used to determine the location of the piston ring on the film trace. Once the ring was satisfactorily placed, several points of data were taken from the trace. Figure 1 shows the placement of the ring profile on an actual film trace. Figure 2 is a idealized sketch of the specific points of data required from each film trace in order to begin the analysis. Placement of the ring and collection of data points was repeated for each revolution, stroke, engine speed, and lubricant type. Appendices B and C provide, in a spreadsheet format, the actual data collected and subsequent data reduction (which will be discussed later) for the exhaust and compression strokes of each oil, respectively.

## 1.4 Choice of Data

Initially, only motored exhaust strokes for oil films under the compression ring were analyzed. Restricting the survey to only the exhaust strokes has several advantages. First, the film traces were clear and distinct. Placement of the compression ring was considerably easier than that of a downstroke.

Second, analysis required an estimate of the pressure difference across the ring. A computer code was developed by Hoult which predicts blowby across the rings, as well as the pressure on each of the piston lands. This code was developed from the work of Namazian and Heywood. In order to reduce the effects of inaccuracies in this code and to reduce the actual pressure loading term on the ring itself, it was decided to use only the exhaust stroke for initial analysis.

Third, by motoring the engine and allowing all temperatures to stabilize, a more accurate estimate of oil temperature under the compression ring could be made. An identical Kubota engine was equipped with temperature sensors in three positions along the cylinder liner. This engine was run at the same operating conditions as the test engine and the cylinder liner temperatures were recorded. Since the engine was being motored and all engine conditions were stable, the oil temperature was estimated to be the same as the cylinder liner temperature. Information concerning the HTHS viscosity of each lubricant was provided by Benchaita. This data was interpolated to determine the actual viscosity at the estimated temperatures of the oils.

Finally, an analysis methodology and supporting theory was developed using the exhaust stroke data. This allowed for analysis of the remaining strokes to progress at a much quicker pace.

## 1.5 Assumptions/Approximations

The data analysis which is presented begins with the Reynolds equation for lubrication theory as described by Cameron. Prior to theory development, several

assumptions and approximations are made in order to simplify the problem. Assumptions are those conditions which are commonly accepted as valid when solving the Reynolds equation and used throughout this paper.

1. There are no external forces acting on the lubricant. No electrical or magnetic forces are considered to be influencing the performance of the oil.
2. The pressure is constant throughout the thickness of the film. This is considered to be acceptable since the film thickness is only several microns thick.
3. There is no slip at the boundary. This is a standard assumption of fluid dynamics and states that the fluid on a boundary is moving at the same velocity as the boundary.

Several approximations are made during the analysis to simplify the problem. The approximations made here will play a major role in the conclusions drawn at the end of the analysis.

1. The lubricant is Newtonian. A Newtonian fluid is one whose rate of shear is proportional to the stress.
2. The Reynolds number is $<< 1$. This approximation eliminates the inertial effects of the lubricant flow. As will be shown later, the actual Reynolds numbers for the oils are $0.8 < R < 4.0$.
3. The viscosity is considered to be constant throughout the thickness of the film. Since the film is only several microns thick and only motored data was analyzed, the temperature gradient between the liner and piston is considered to be negligible.

The major thrust of this research is to achieve correlation between the film thickness and the lubricant rheology when studied on a cycle by cycle basis. If there is correlation, then the approximations made were valid and conclusions can be drawn accordingly.

# CHAPTER 2 - THEORY

## 2.1 Background

### 2.1.1 Lubrication Equation

Cameron provides the development of lubrication theory for fluid moving past a wedge. Application of this theory to a moving piston ring requires slight modification. The development of theory relevant to a piston ring begins with the one dimensional Reynolds equation as defined by Cameron:

$$\frac{\partial}{\partial x}\left(h^3\frac{\partial P}{\partial x}\right) = 6U\mu\frac{dh}{dx} \tag{1}$$

### 2.1.2 Boundary Conditions

Figure 2 defines terms used in the solution of the Reynolds equation for the compression ring of the diesel engine under study. The ring features will be non-dimensionalized later to make the theory applicable to generic piston rings. The boundary conditions used in the solution are simple:

$$P(0) = P_{\text{Crown land}} \tag{2}$$

$$P(b) = P_{\text{Second land}} \tag{3}$$

$$h = h(x) \tag{4}$$

## 2.2 Non-dimensionalization

### 2.2.1 Ring Features

The next step is to non-dimensionalize the piston ring features. Several new terms are defined and used throughout the remainder of the analysis. Non-dimensionalization is accomplished by defining:

$$\bar{h} = \frac{h}{h_o} \tag{5}$$

$$\bar{x} = \frac{x}{b} \tag{6}$$

$$\bar{P} = \frac{Ph_o}{6U\mu b} \tag{7}$$

$$\Gamma_1 = \frac{(\delta_1 + h_o)}{h_o} \tag{8}$$

$$\Gamma_2 = \frac{(\delta_2 + h_o)}{h_o} \tag{9}$$

$\Gamma_1$ and $\Gamma_2$ are not required for the solution of Reynolds equation in non-dimensional terms. They are introduced here because of the significance of the terms in §3.1.

### 2.2.2 Reynolds equation

Forming the non-dimensional Reynolds equation simply requires substituting equations (5), (6), and (7) into equation (1). By doing so, one obtains the following:

$$\frac{\partial}{\partial \bar{x}}\left(\bar{h}^3 \frac{\partial \bar{P}}{\partial \bar{x}}\right) = \frac{d\bar{h}}{d\bar{x}} \tag{10}$$

Non-dimensionalization of the boundary conditions yields the following results for $\bar{h} = \bar{h}\,(\bar{x}; \Gamma_1, \Gamma_2)$:

$$\bar{h}\,(0) = \Gamma_1 \;\; , \;\; \bar{h}\,(1) = \Gamma_2 \tag{11}$$

$$\bar{P}(0) = P_1 = \left(\frac{h_o^2}{6U\mu b}\right) P_{\text{Crown land}} \tag{12}$$

$$\bar{P}(1) = P_2 = \left(\frac{h_o^2}{6U\mu b}\right) P_{\text{Second land}} \tag{13}$$

## 2.3 Scaling Laws

### 2.3.1 Bearing Number

After non-dimensionalizing the piston ring features, one must try to connect theory to observed data. This is accomplished by introducing the bearing number, a non-dimensional lift term. The bearing number is derived by examining the lift, W, generated by the piston ring, where;

$$W = \frac{\Delta P B 2\pi R}{2\pi R} \tag{14}$$

and $\Delta P$ is the pressure difference across the ring and B is the width of the ring. The lift, W, is the lift generated along the entire circumference of the piston ring. Lift is also defined as the area under the pressure distribution below the ring as shown in equation (15):

$$W = \frac{6U\mu b^2}{h_o^2} \int_0^1 \bar{P}\, d\bar{x} \tag{15}$$

Since equations (14) and (15) are expressions for the lift generated by the ring, they can be equated:

$$\Delta P B = \frac{6U\mu b^2}{h_o^2} \int_0^1 \bar{P}\, d\bar{x} \tag{16}$$

The bearing number, defined as

$$\frac{6U\mu b^2}{\Delta P B\, h_o^2} = f\,(\,\Gamma_1,\Gamma_2,P_1,P_2\,) \tag{17}$$

is a function of the inlet and outlet wetting conditions, as well as the pressure loading on the ring.

To eliminate some of the variables, the effect of the pressure loading is theoretically investigated by using a C-language program, *Pressure.c*. This program is similar to the code used by McElwee for predicting the pressure distribution under the piston ring. Its development is outlined in Appendix A. Figure 3 shows a typical pressure distribution for an exhaust stroke. The pressure trace has the non-dimensional axes as discussed in the appendix. Of particular note is the maximum value of the non-dimensional pressure (~0.04). Since $P_1$ and $P_2$ are on the order of $10^{-3}$ for any given film shape, the load varies by only 2-4%. Therefore, the bearing number (N) is reduced to a function only of the inlet and outlet ring wetting dimensions:

$$N = \frac{6U\mu b^2}{\Delta PBh_o^2} = f(\Gamma_1, \Gamma_2) \tag{18}$$

Equation (18) implies that if our the initial assumptions and approximations are valid, then the bearing number should be a function of only inlet and outlet variability.

### 2.3.2 Drag

The development of the equations for the friction force (drag) is according to Cameron. It begins with the definition of a Newtonian fluid:

$$\tau = \mu \frac{\partial u}{\partial z} \tag{19}$$

Cameron continues to develop the shear stress relationship and arrives at equation (20) in dimensional terms.

$$\tau(x) = \frac{\mu U}{h(x)} - \frac{\partial P}{\partial x}\frac{h(x)}{2} \tag{20}$$

The drag force is obtained by integrating the shear stress over the length of contact:

$$D = \int_0^b \tau(x)\, dx \tag{21}$$

Finally, the drag force is placed in non-dimensional terms:

$$C_D = \left(\frac{h_o}{U\mu b}\right) D \tag{22}$$

To correlate the drag on the ring, the coefficient is analyzed to be a function of the inlet condition. This will provide a relationship for drag on the ring in terms of the inlet condition similar to the bearing number:

$$C_D = f(\Gamma_1) \tag{23}$$

# CHAPTER 3 - RESULTS

## 3.1 Exhaust Stroke

### 3.1.1 Difference between lubricants

Figure 4 depicts the inlet variability of each of the five oils tested. Note the difference in magnitude of the inlet condition for each oil. The single-grade oils appear to wet the ring more than the multi-grade oils do. The error bars are an indication of the maximum and minimum values of inlet ring wetting. These two observations are the essence of the difference between single and multi-grade lubricants.

### 3.1.2 Bearing Number versus $\Gamma_1$

Figure 5 is a plot of inlet variability versus the bearing number. The data points plotted are for the exhaust strokes of all five oils. The data points correlate to a fairly high degree. Although the data points appear to be linear, it is not discernable that the data cannot be segregated by lubricant type or if inertial effects account for the spread in the data.

Figure 6 explores the possibility whether the data can be segregated by lubricant type or not. Data for each of the five oils under investigation is equally distributed throughout the spread. This indicates that the type of lubricant is not an important factor. Each of the five oils exhibit Newtonian behavior under the top ring.

Figure 7 examines the possibility that inertial effects account for the separation of data. The inlet variability is plotted against bearing number for different ranges of Reynolds number. No apparent division of data due to Reynolds number is observed. This indicates that inertial effects do not influence the Newtonian characteristics of the oil film.

Figures 5-7 show that the fluid under the rings is Newtonian and the effects are independent of lubricant type and inertia. If the oil was not Newtonian, one would expect complete scatter of the data with no correlation evident in any of these figures.

The straight line correlation between $\Gamma_1$ and bearing number is expressed in the following equation:

$$\Gamma_1 = 1.1138 + 4.8412 \times 10^{-3} N \qquad (24)$$

where N is the bearing number.

### 3.1.3 $\Gamma_1$ versus $\Gamma_2$

The results in §3.1.2 show that the fluid under the top ring is Newtonian. However, the theory developed earlier predicts that the bearing number is not simply a function of the inlet condition but the outlet condition as well. Figure 8 is a plot of the inlet versus outlet variability. It would simplify the theory greatly if there was a direct correlation between the inlet and outlet film conditions, but Figure 8 does not show any correlation. One reason that this correlation is not readily apparent, is because the outlet condition is the most difficult ring feature to place during the data analysis. The inlet condition is well defined, as is the minimum oil thickness. The outlet condition is often a subjective placement due to the fluorescent signal provided. In the analysis, the placement of the ring was made consistently from cycle to cycle, however, the subjective nature of the outlet condition no doubt accounts for some of the data scatter.

The possible correlation between the inlet and outlet condition is examined in the following section.

In order to explore the relationship between the inlet and outlet wetting condition, several random exhaust stroke film traces were profiled. Figure 9 shows the digitized ring contour of the film traces. The contours have been non-dimensionalized as discussed previously. From these contours, several observations can be made:

1. The inlet condition plots as x(0) and the outlet condition as x(1).
2. The minimum non-dimensional film thickness occurs at x(0.6) and equals one, as expected.

These observations were used to calculate a generic second-order polynomial contour for a values of $\Gamma_1$ shown in Figure 10. These values of inlet wetting were chosen to be representative of the data and provide a number of values in order to perform various calculations. The coefficients of the second-order polynomial were entered as input into Pressure.c. This process was repeated with different values of $\Gamma_2$ until the bearing number from Pressure.c matched that of the observed data exactly. The final values of $\Gamma_2$ which predicted the observed bearing number are shown in Table 1.

Table 1

| $\Gamma_1$ | $\Gamma_2$ | $\Gamma_1 / \Gamma_2$ |
|---|---|---|
| 1.35 | 1.074 | 1.26 |
| 1.70 | 1.39 | 1.22 |
| 2.10 | 1.705 | 1.23 |
| 2.60 | 2.095 | 1.24 |

Table 1 provides valuable information concerning the behavior of the lubricant as it wets the ring. The relationship between inlet and outlet conditions is a constant value, so the bearing number can be reduced to a function of a single variable:

$$\frac{6U\mu b^2}{\Delta PBh_o^2} = f(\Gamma_1) \tag{24}$$

Figure 11 shows that the relationship between inlet and outlet conditions falls within the data generated.

### 3.1.5 Drag

The non-dimensional drag coefficient for each of the four values of $\Gamma_1$ derived in Figure 10 have been plotted in Figure 12. This figure implies that the drag on the top ring increases as $\Gamma_1$ decreases. A third order polynomial curve fit passes through the data with excellent correlation. The equation of this fit provides a means to predict drag for a given value of $\Gamma_1$.

$$\Gamma_1 = 65.765 - 186.83C_D + 179.47C_D^2 - 57.034C_D^3 \tag{25}$$

## 3.2 Compression Stroke

An identical analysis was performed on the compression strokes for the 5 oils at each of the operating conditions as that performed on the exhaust strokes. Figures 13-16 highlight the results of this analysis. Several items are worth noting when reviewing the results of the compression stroke data analysis.

1. Figure 13 outlines the differences between oils for the compression stroke.
2. The Newtonian correlation is still evident is Figure 14. Again, no segregation of oil type can be made nor are there any inertial effects present in the compression stroke data. The relationship between $\Gamma_1$ and the bearing number is determined to be:

$$\Gamma_{1(COMP)} = 1.3124 + 5.9157x10^{-3}N \tag{26}$$

3. The relationship between inlet and outlet wetting shifts slightly for the compression strokes. This relationship is 1.4:1 for the compression data.
4. The drag coefficient showed a similar trend for the compression strokes. Once again, $\Gamma_1$ and drag are inversely related.

## 3.3 Other Strokes

An investigation of the properties of the downstrokes was also performed for each of the five lubricants. This analysis is not as detailed for several reasons. The

typical film trace of a downstroke is shown in Figure 17. Note the relatively flat region in the area of the ring groove (-9.5 mm to -11.5 mm). The flatness of the film trace is not distinctive enough in its features to allow the ring contour to be accurately placed. The ring, in these cases, appears to ride over the film and not be fully wetted by the oil.

The analysis was conducted in an effort to determine three characteristics of the downstrokes:

1. The relationship between $\Gamma_1$ and $\Gamma_2$,
2. Differences between lubricants, if any, and
3. To determine if enough lift is generated to support the ring.

The analysis shows that the compression ring is not fully flooded on the downstrokes. The oil does not wet the ring above the ring face contour as consistently as it wets the ring on the upstrokes. Several digitized film traces were examined and the relationship between $\Gamma_1$ and $\Gamma_2$ is 1.05:1. This relationship is much different that that for the upstrokes.

The relationship between $\Gamma_1$ and $\Gamma_2$ suggests that the inlet and outlet wetting are very nearly the same. In each of the five oils this numerical relationship is consistent Some oils display slightly thicker films but maintain the established connection between $\Gamma_1$ and $\Gamma_2$ .

Each of the film traces examined were digitized and polynomial fits obtained in the same manner as in §3.1.3. The engine operating conditions and film characteristics were entered into Pressure.c in order to determine the lift in each case. A positive lift for a majority of the cases was obtained indicating that the film trace can still support the ring. Several values of negative lift were obtained. This is due to the small difference between $\Gamma_1$ and $\Gamma_2$ . In these cases the digitized profile of the trace showed that the outlet wetting was slightly higher ( ~0.1 - 0.2 μm) than the inlet condition. This gives negative lift but is well within the accuracy of the data.

## CHAPTER 4 - CONCLUSIONS

The results described in §3 show that the approximations made during theory development were valid. Some very interesting conclusions may be drawn about the data analysis performed for the 5 lubricants:

1. The lubricant under the compression ring is Newtonian. This conclusion is reached *independent* of lubricant type (single or multi-grade).
2. The primary difference between lubricants is the manner in which the ring is wetted. The single-grade oils appear to wet the ring more thoroughly than the multi-grades.
3. The minimum oil film thickness typically occurs at a point 60% from the inlet wetting point on the ring. This permits calculation of the film contour and prediction of the bearing number.
4. There is a consistent linear relationship between the inlet to outlet wetting conditions of ~ 1.24 for exhaust strokes. This relationship is approximately 1.39 to 1 for compression strokes.
5. The linear relationships between $\Gamma_1$ and bearing number (N) vary with the type of stroke and are defined as follows:

$$\Gamma_{1(EXH)} = 1.1138 + 4.8412 \times 10^{-3} N$$

$$\Gamma_{1(COMP)} = 1.3124 + 5.9157 \times 10^{-3} N$$

6. The relationship between $\Gamma_1$ and $\Gamma_2$ for the downstrokes is 1.05:1. This suggests that the ring is just skimming the oil film. Even if this is the case, there is still enough lift generated to support the ring.

7. Non-dimensional drag is inversely proportional to inlet wetting. As $\Gamma_1$ increases, drag is reduced. This trend is consistent for both exhaust and compression strokes. A third-order polynomial curve fit describes this relationship.

$$\Gamma_1 = 65.765 - 186.83C_D + 179.47C_D^2 - 57.034C_D^3$$

## REFERENCES


Bates, T.W., et al. "A Correlation Between Engine Oil Rheology and Oil Film Thickness in Engine Journal Bearings." SAE Technical Paper Series #860376

Benchaita, M. Tayeb. Pennzoil Products Company. Personal Correspondence to Dr. David Hoult, Massachusetts Institute of Technology. December 21, 1989.

Cameron, A. Basic Lubrication Theory. 3rd Edition. New York: John Wiley and Sons, 1981.

Cameron, A. The Principles of Lubrication. New York: John Wiley and Sons, 1966.

Crandall, Stephan H. Engineering Analysis-A Survey of Numerical Procedures. Malabar, Florida: Robert Krieger Publishing Company, 1986.

Deysarkar, Asoke. "The Bearing Oil Film Thickness of Single and Multi-Grade Oils-Part1: Experimental Results in a 3.8L Engine." SAE Technical Paper Series #880681.

Hoult, D.P., Billian, S., Lux, J.P., and Wong, V.W. "Calibration of Laser Fluorescence Measurements of Lubricant Film Thickness in Engines." SAE Technical Paper Series #881587.

Lux, Jeffery P. "Lubricant Film Thickness Measurements in a Diesel Engine." Master's thesis, Massachusetts Institute of Technology, 1989

McElwee, Mark. "Comparison of Single-Grade and Multi-Grade Lubricants in a Production Diesel Engine." Master's thesis, Massachusetts Institute of Technology, 1990.

Namazian, M. and Heywood, J. "Flow in the Piston-Cylinder-Ring Crevices of a Spark-Ignition Engine: Effect on Hydrocarbon Emissions, Efficiency and Power." SAE Technical Paper Series #820088.

Spearot, J.A., Murphy, C.K., and Deysarkar, A.K. "Interpreting Experimental Bearing Oil Film Thickness Data." SAE Technical Paper Series #892151.

Spearot, J.A., Murphy, C.K., and Rosenberg, R.C. "Measuring the Effect of Oil Viscosity on Oil Film Thickness in Engine Journal Bearings." SAE Technical Paper Series #831689.

FIGURES

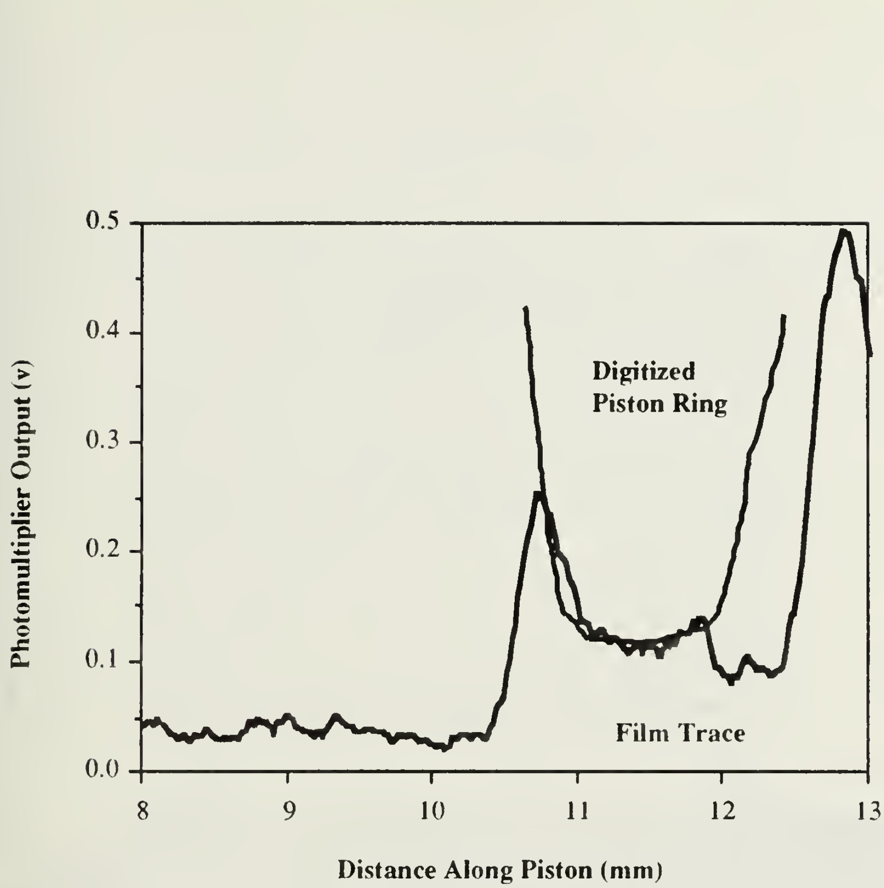
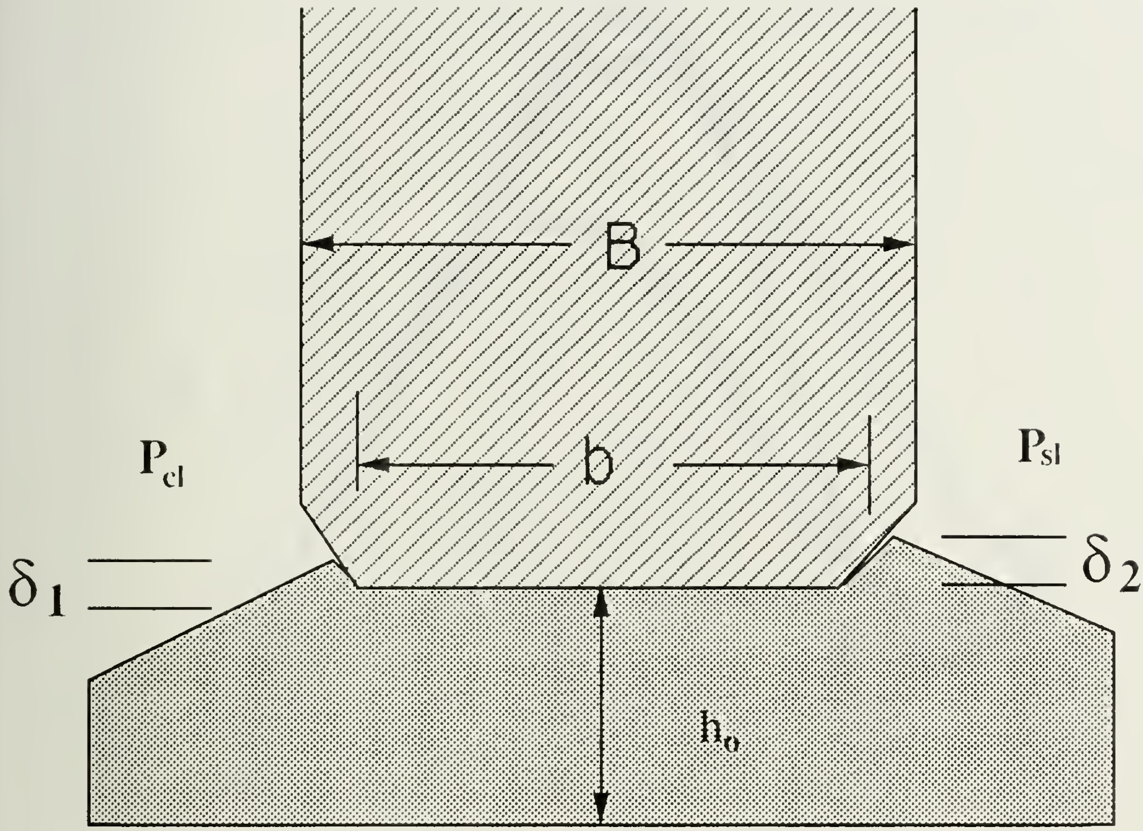



Figure 1 - Schematic of method used to place the ring on an individual film trace. Each revolution was examined in this manner and the data recorded in a spreadsheet (see Appendix B).




$$\Gamma_1 = \frac{(\delta_1 + h_o)}{h_o} \qquad \Gamma_2 = \frac{(\delta_2 + h_o)}{h_o}$$

Figure 2 - Definition of terms used in the solution of the Reynold's equation for the lubricant under the compression ring.

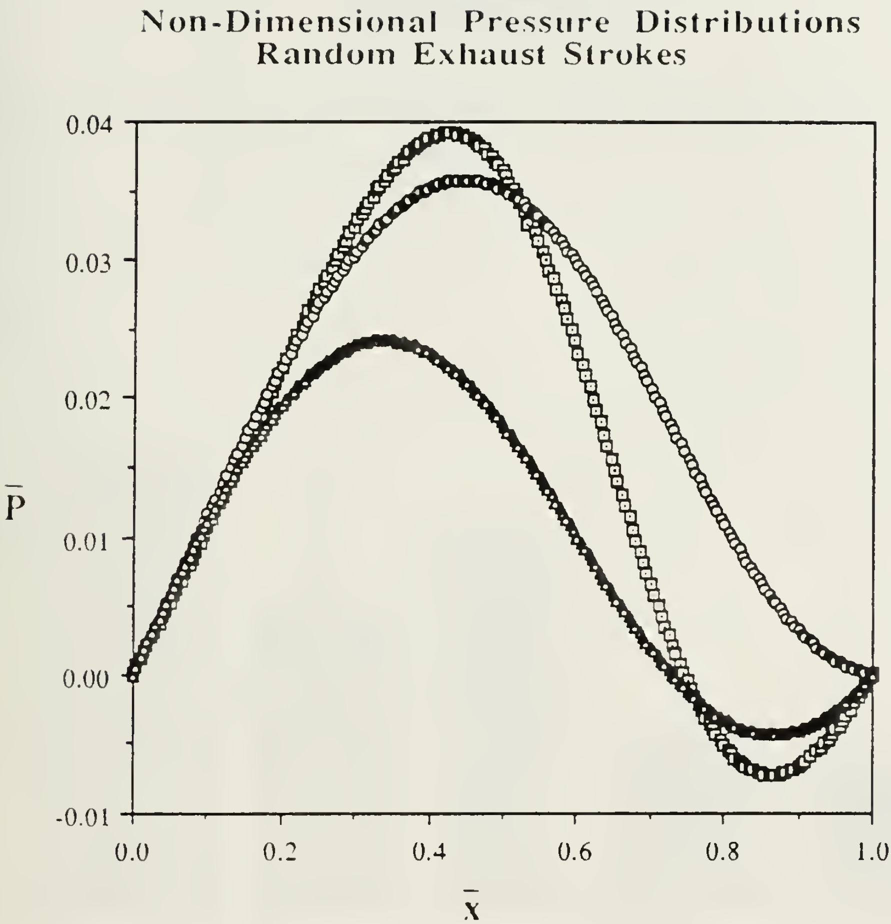



Figure 3 - Non-dimensional pressure distributions under three randomly selected wetted ring contours. Note that the value of P bar is ~0.3 - 0.4 for any selected contour. This, combined with the fact that P1 and P2 are on the order of 0.001, eliminate the pressure difference as a major contributor to the bearing number.

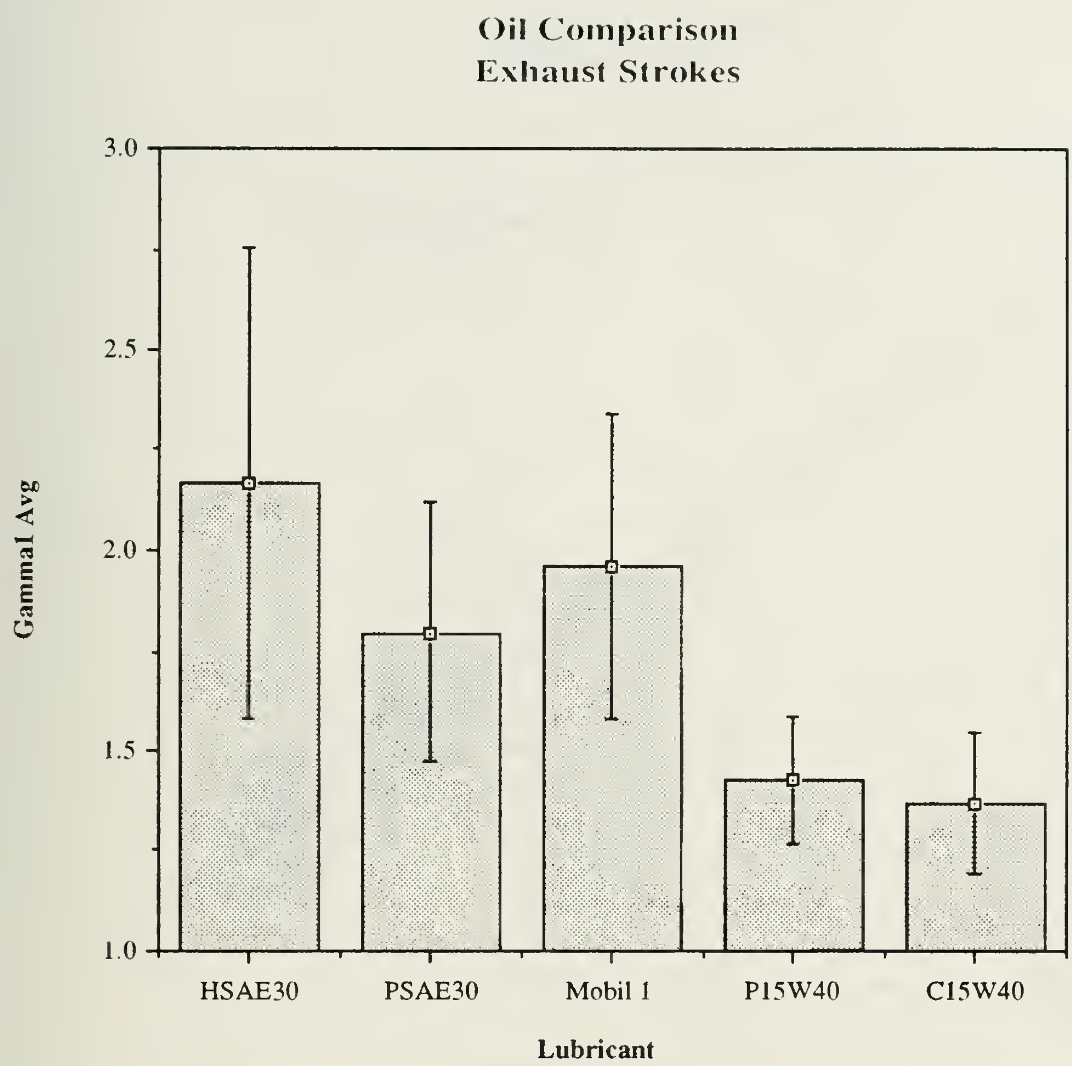



Figure 4 - Comparison of inlet variability for the five lubricants under investigation. Notice that the single-grade oils appear to "wet" the ring more than the multi-grades do.

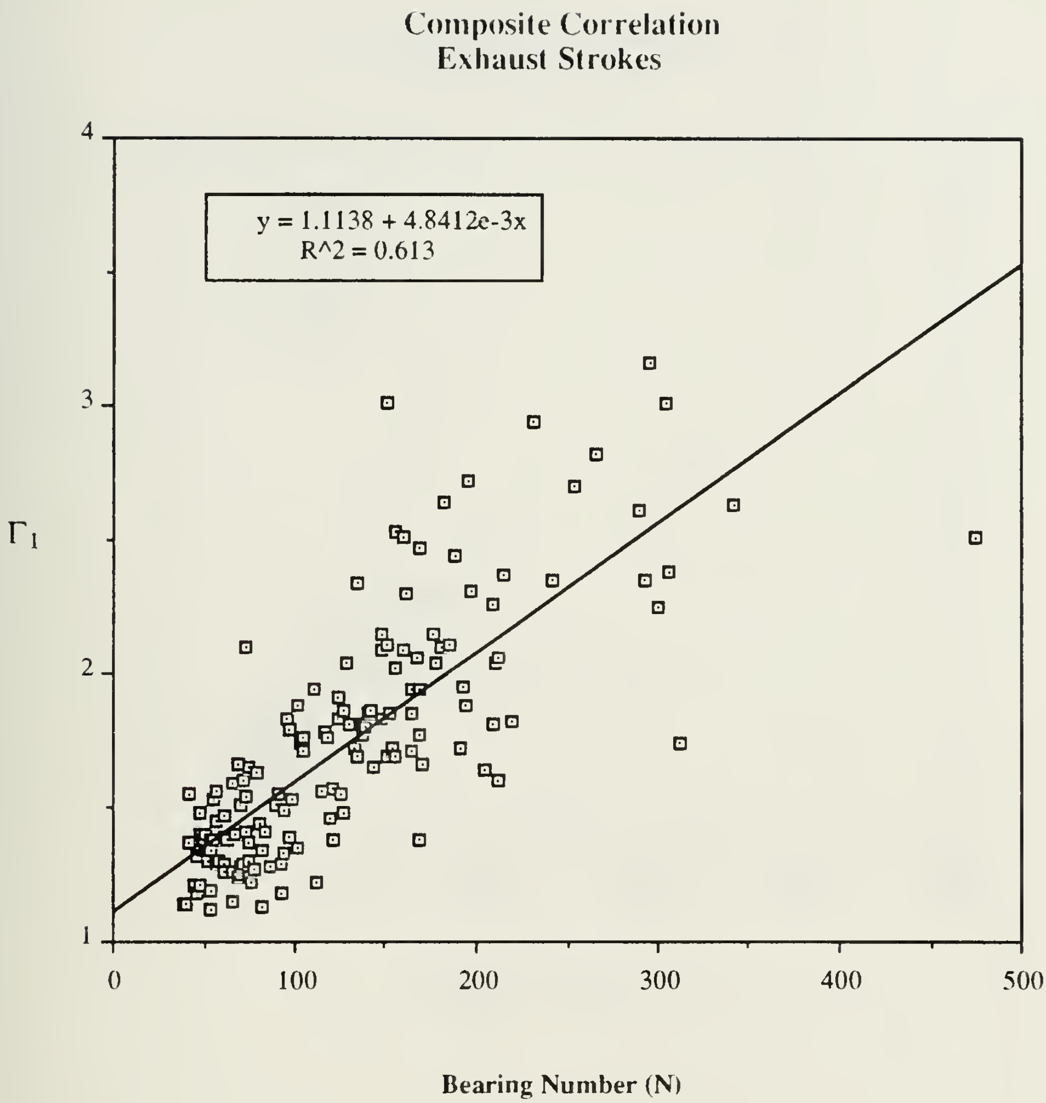



Figure 5 - Inlet variability plotted versus bearing number (N). Notice the correlation which demonstrates the Newtonian behavior of the lubricant under the compression ring.

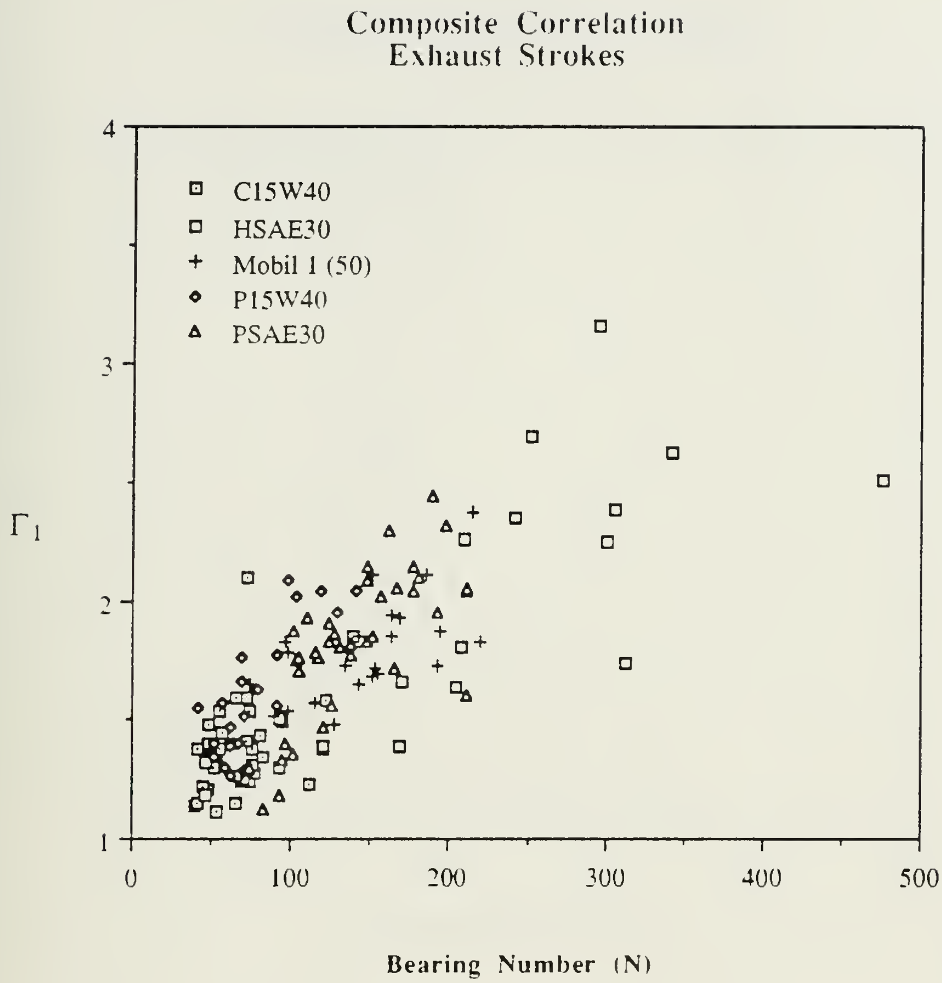



Figure 6 - Inlet variability plotted versus the bearing number (N) and data separated by lubricant type. Notice that there is no observable difference between the single-grade or multi-grade oils when plotted in this fashion.

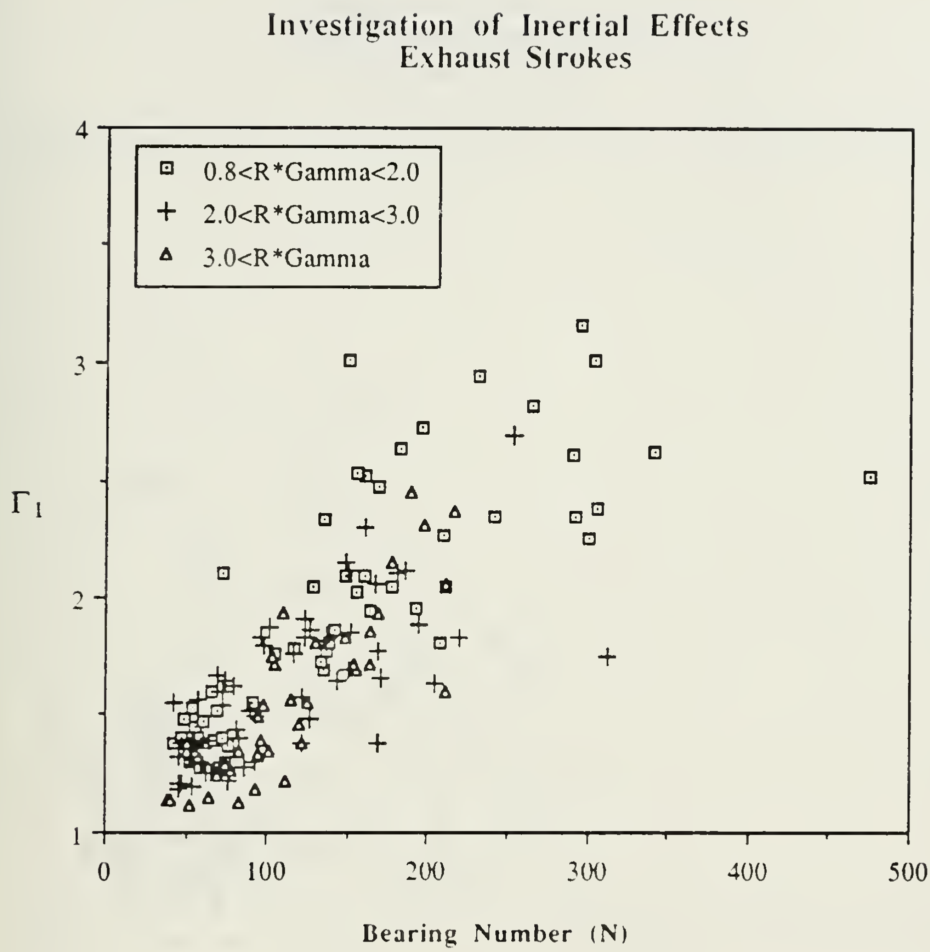



Figure 7 - Plot of bearing number (N) versus inlet variability with data separated by Reynolds number. Notice that there is no apparent grouping of data due exclusively to inertial effects.

Comparison of Inlet vs. Outlet
Conditions of Variability
Exhaust Strokes

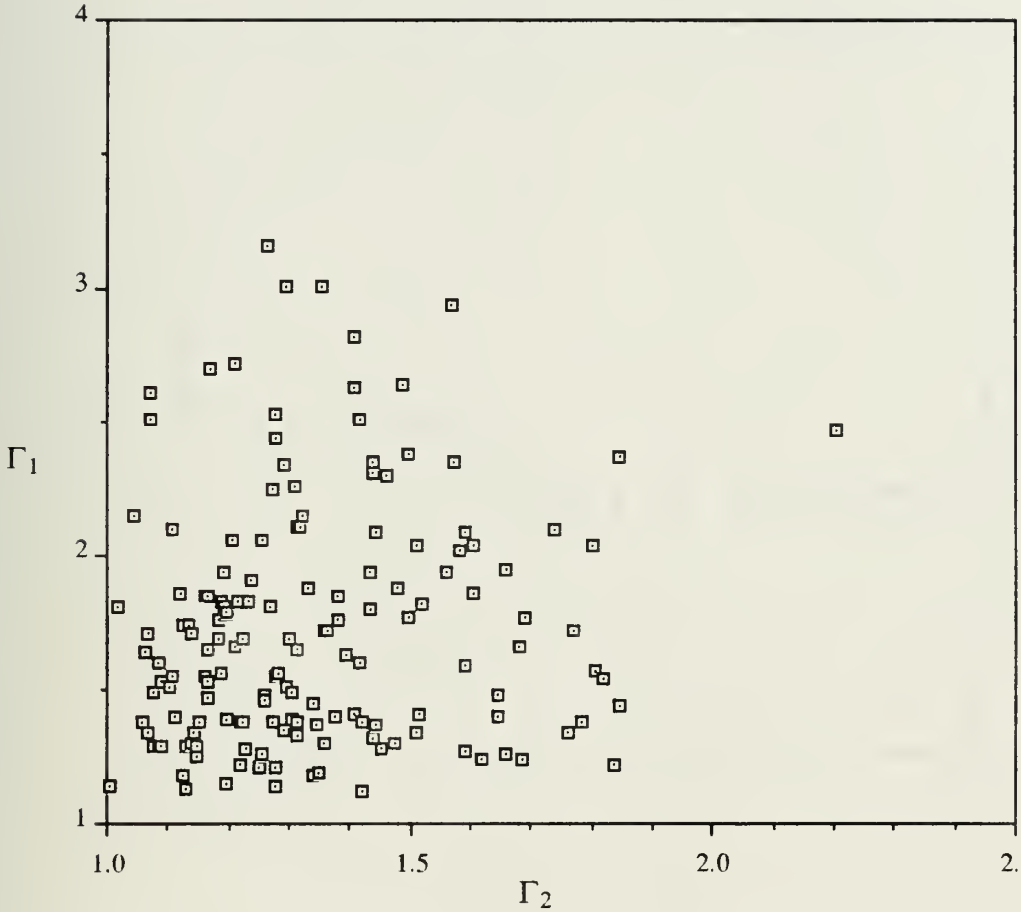



Figure 8 - Plot of inlet variabilitry versus outlet variability. The data scatter is due mainly to the difficulty in placing the ring with respect to the outlet film trace.

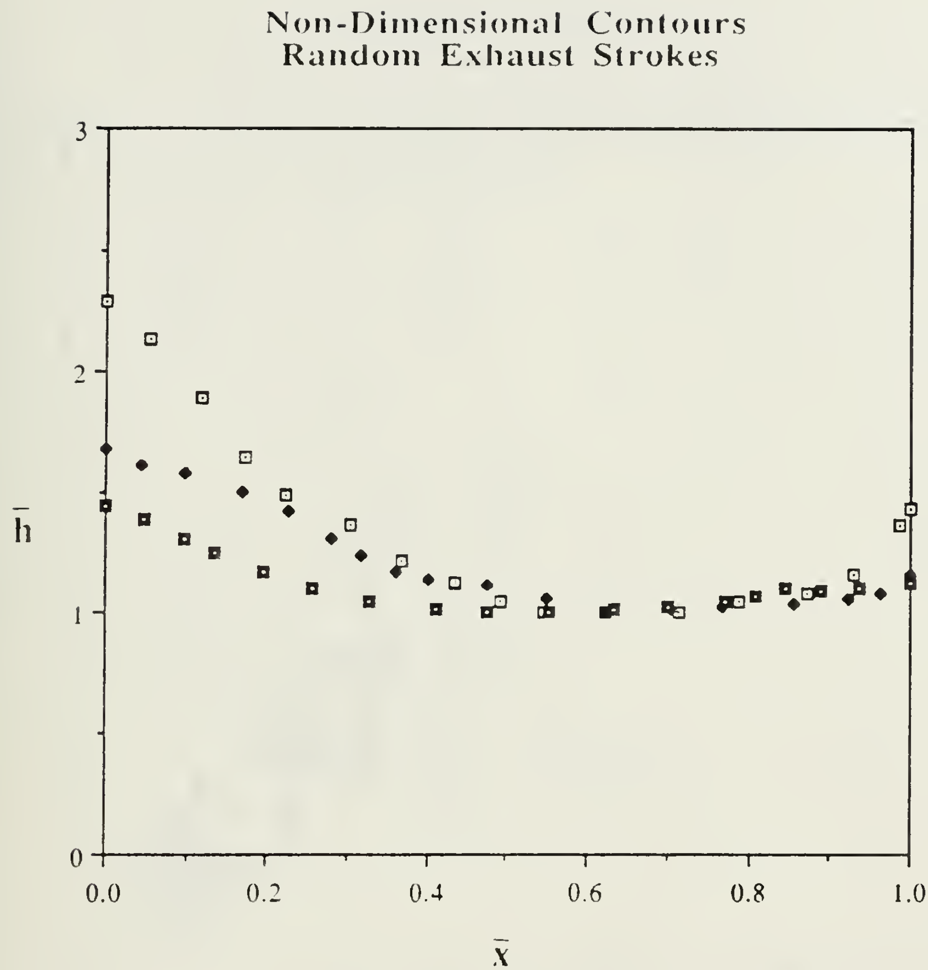



Figure 9 - Random ring contours of film traces from several exhaust strokes. Note that the minimum value of h bar (minimum oil film thickness) appears to occur at 0.6 consistently.

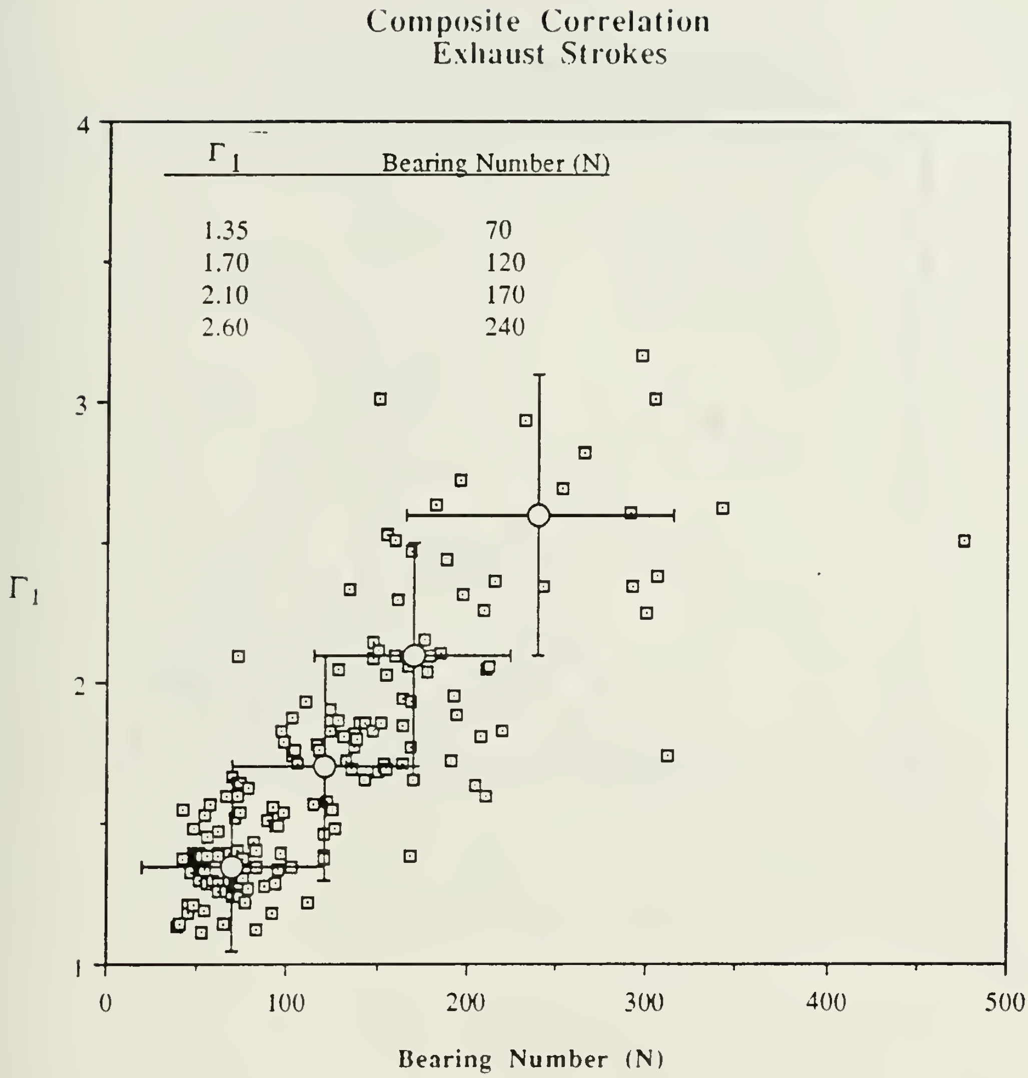



Figure 10 - Plot of inlet conditions versus bearing number (N) showing the methodology for selecting representative values of inlet wetting to be used in further calculations.

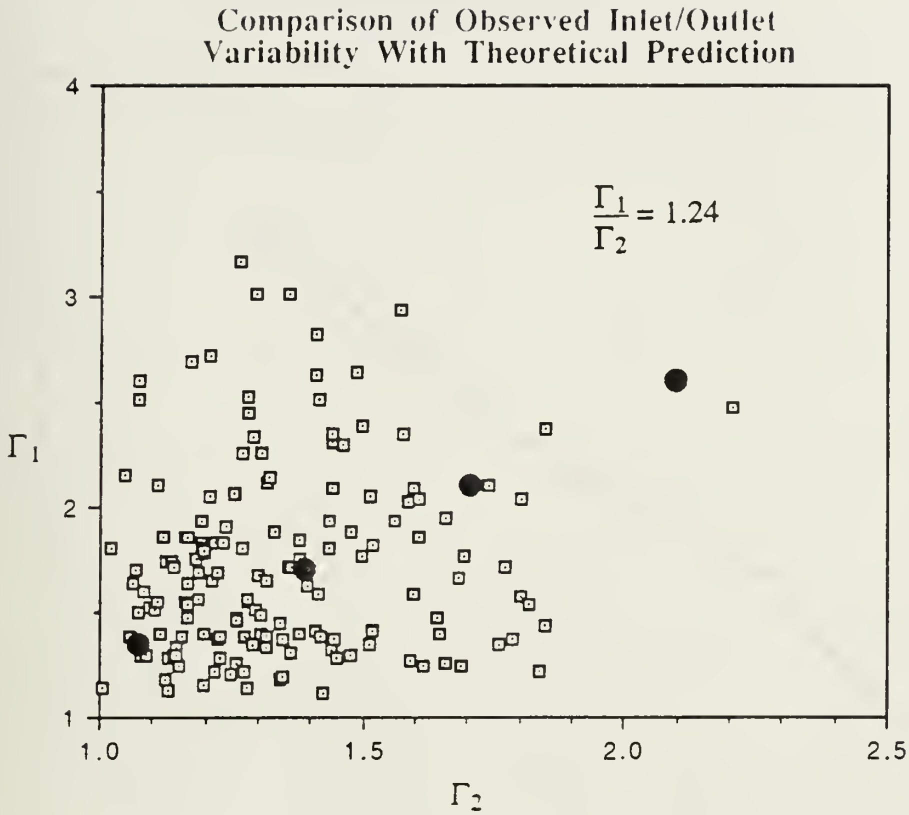



Figure 11 - Plot of the inlet versus outlet variability with the relationship predicted by theory overlaid. The large points are the theoretical prediction with the relationship shown.

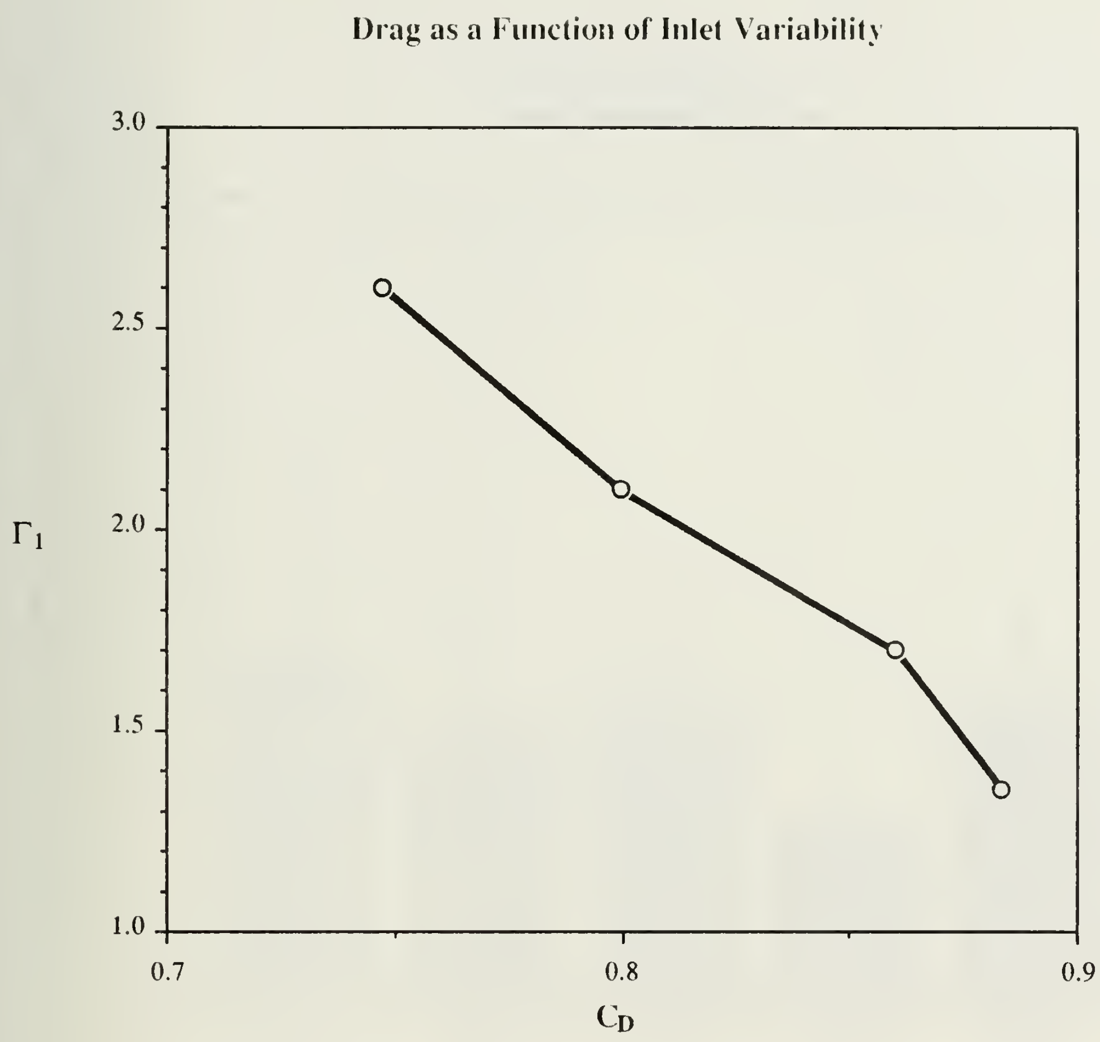



Figure 12 - Non-dimensional drag plotted as a function of inlet conditions. Notice that as Gamma1 gets larger the drag on the ring is reduced.

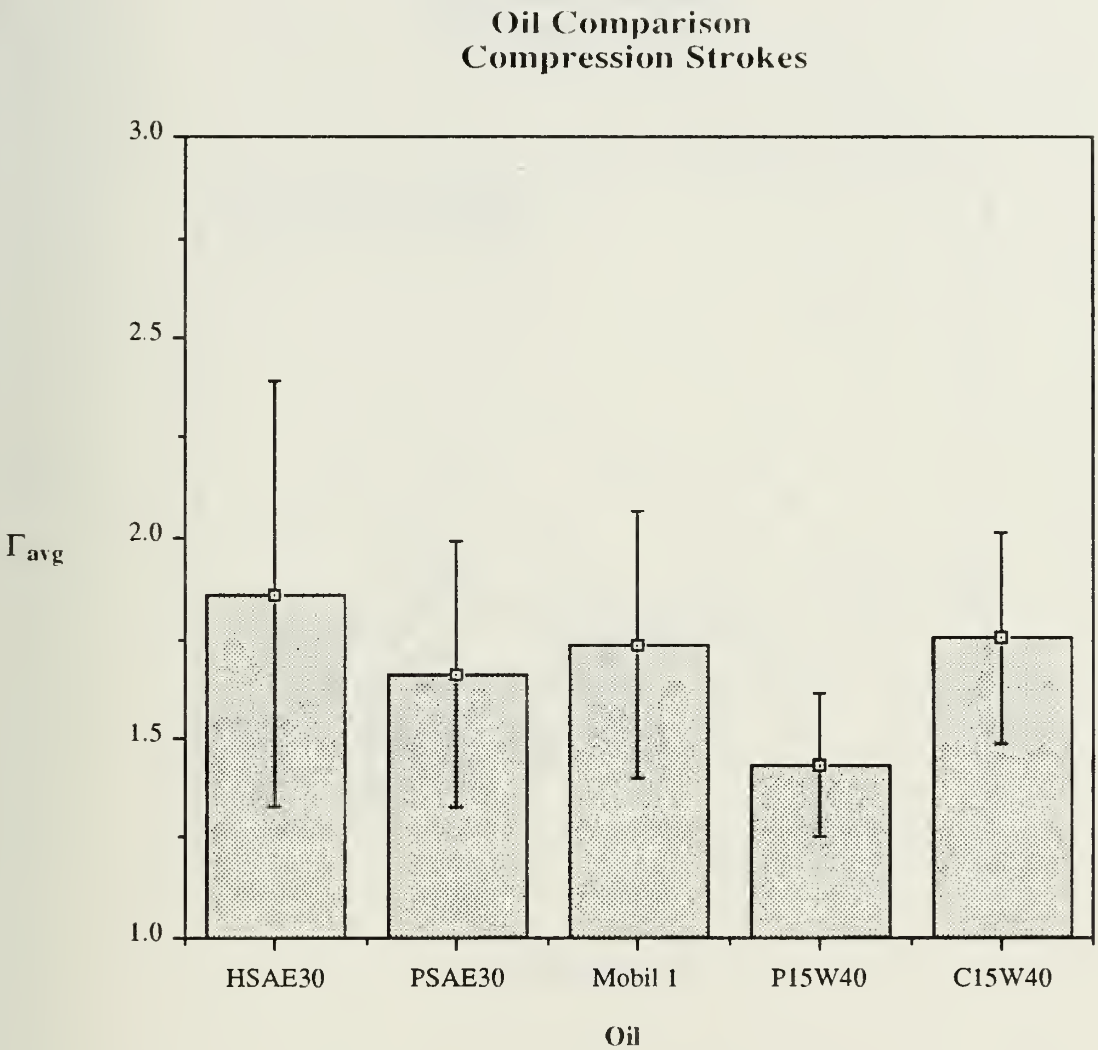



Figure 13 - Comparison of inlet variability versus lubricant type for each of the five oils tested. This is the same analysis that was done for the exhaust strokes as shown in Figure 4.

Composite Correlation
Compression Strokes

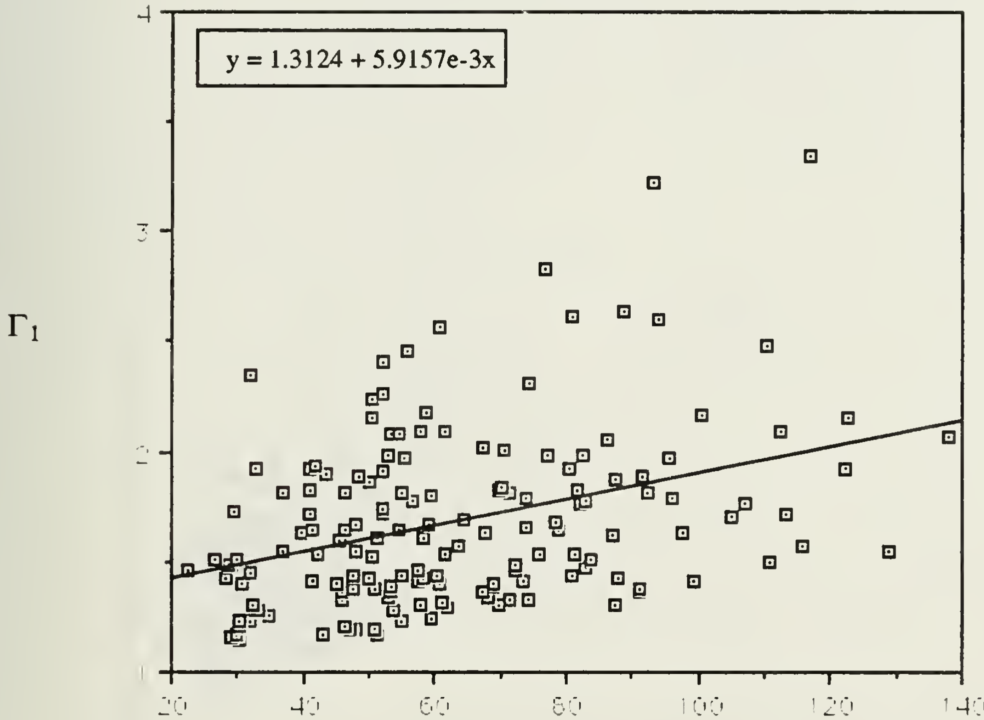



Figure 14 - Inlet variability plotted versus bearing number (N) for the compression strokes. Notice the Newtonian correlation which is present similar to that of the exhaust strokes in Figure 5.

Comparison of Inlet/Outlet Variability with
Theoretical Prediction
(Compression Strokes)

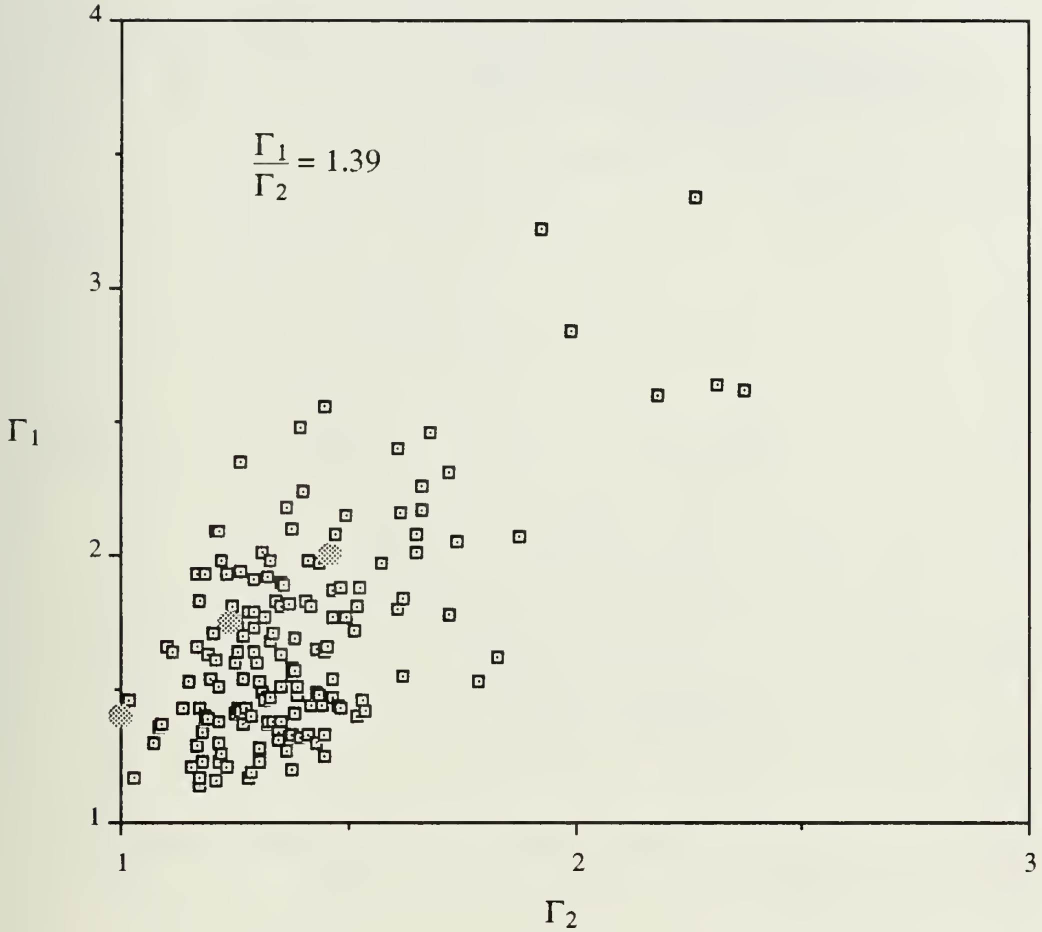



Figure 15 - Plot of inlet wetting versus outlet variability for each of the compression strokes. The overlay points are the predicted values of outlet wetting for a specified value of inlet wetting. The relationship is shown above.

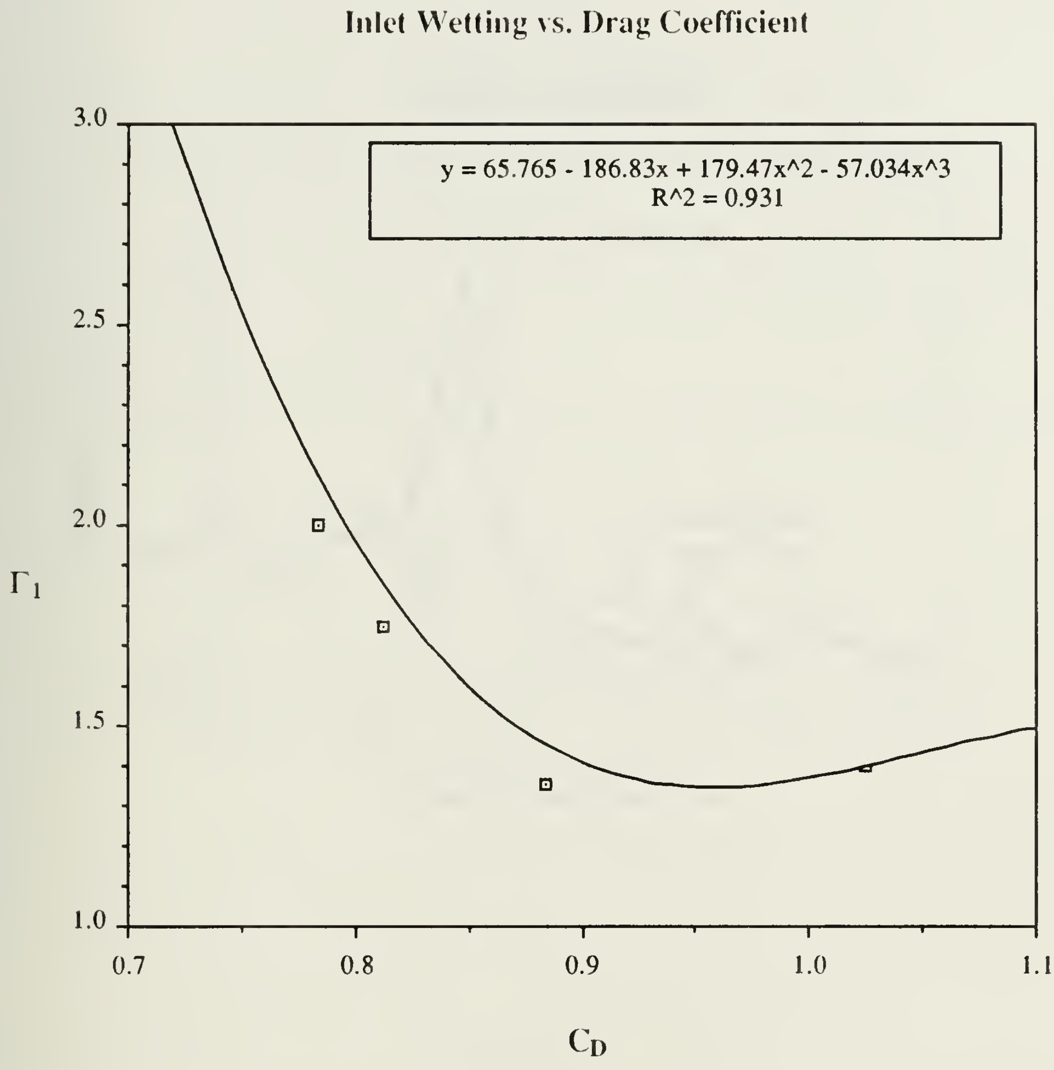



Figure 16 - Drag coefficient for the compression strokes added into Figure 12 (exhaust strokes). Note the increase in drag coefficient as inlet wetting decreases. The curve fit is a third-order polynomial with very good correlation.

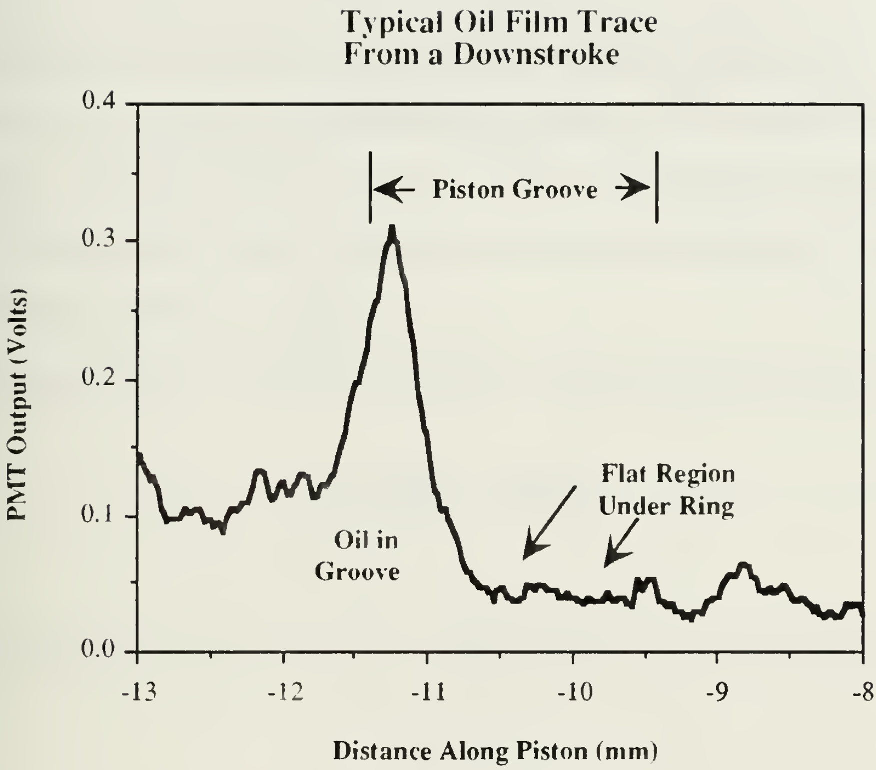



Figure 17 - Typical downstroke film trace for any lubricant. The ring groove is from -9.5mm to -11.5mm. The lump of oil at ~-11.5mm is in the ring groove and the flat region at ~-10mm is under the ring. There is no distinct ring feature that can be used to accurately place the ring.

## APPENDIX A - Development of Pressure.c

This appendix describes the solution of the one dimensional Reynolds equation using a centered finite-difference approximation. This solution was used to develop the C-language program, Pressure.c, which is included at the end of this appendix. The equation numbers used in the comment lines of Pressure.c correspond to the following development scheme.

Development begins with the one-dimensional Reynolds Equation from Cameron :

$$\frac{\partial}{\partial x}\left(h^3\frac{\partial P}{\partial x}\right) = 6U\mu\frac{dh}{dx} \qquad \text{(A1)}$$

Non-dimensionalization of (A1) is accomplished with the following definitions:

$$\bar{h} = \frac{h}{h_o} \qquad \text{(A2)}$$

$$\bar{x} = \frac{x}{b} \qquad \text{(A3)}$$

$$\bar{P} = \frac{Ph_o^2}{6U\mu b} \qquad \text{(A4)}$$

$$\Gamma_1 = \frac{(\delta_1 + h_o)}{h_o} \qquad \text{(A5)}$$

$$\Gamma_2 = \frac{(\delta_2 + h_o)}{h_o} \qquad \text{(A6)}$$

Substituting (A2), (A3), and (A4) into (1), the following non-dimensional Reynolds equation is obtained:

$$\frac{\partial}{\partial \bar{x}}\left(\bar{h}^3 \frac{\partial \bar{P}}{\partial \bar{x}}\right) = \frac{d\bar{h}}{d\bar{x}} \qquad (A7)$$

Expanding the left hand side of (A7):

$$\bar{h}^3 \frac{\partial^2 \bar{P}}{\partial \bar{x}^2} + 3\bar{h}^2 \frac{\partial \bar{h}}{\partial \bar{x}} \frac{\partial \bar{P}}{\partial \bar{x}} = \frac{d\bar{h}}{d\bar{x}} \qquad (A8)$$

Divide both sides by $\bar{h}^3$:

$$\frac{\partial^2 \bar{P}}{\partial x^2} + \frac{3}{\bar{h}} \frac{\partial \bar{h}}{\partial x} \frac{\partial \bar{P}}{\partial x} = \frac{1}{\bar{h}^3} \frac{d\bar{h}}{d\bar{x}} \qquad (A9)$$

The non-dimensional contour of the film trace is approximated by a second-order polynomial in the form of :

$$\bar{h}(\bar{x}) = A + B\,\bar{x} + C\bar{x}^2 \qquad (A10)$$

Therefore,

$$\frac{d\bar{h}}{d\bar{x}} = B + 2C\bar{x} \qquad (A11)$$

Substituting (10) and (11) into (9), the following are obtained:

$$\frac{\partial^2 \bar{P}}{\partial \bar{x}^2} + \frac{3(B + 2C\bar{x})}{(A + B\,\bar{x} + Cx^2)} \frac{\partial \bar{P}}{\partial \bar{x}} = \frac{B + 2C\bar{x}}{(A + B\,\bar{x} + Cx^2)^3} \qquad (A12)$$

A standard finite centered-difference approximation is outlined by Crandall and is used to formulate the equation for programming. The approximations used for the partial derivative terms:

$$\frac{\partial^2 \bar{P}}{\partial \bar{x}^2} = \frac{\bar{P}_{i-1} - 2\bar{P}_i + \bar{P}_{i+1}}{\Delta \bar{x}^2} \qquad (A13)$$

$$\frac{\partial \bar{P}}{\partial \bar{x}} = \frac{-\bar{P}_{i-1} + \bar{P}_{i+1}}{2\Delta \bar{x}} \qquad (A14)$$

Substituting (A12) and (A13) into (A11) the following equation is obtained (A14):

$$\frac{\bar{P}_{i-1} - 2\bar{P}_i + \bar{P}_{i+1}}{\Delta\bar{x}^2} + \left[\frac{3(B + 2Ci\Delta\bar{x})}{A + Bi\Delta\bar{x} + C(i\Delta\bar{x})^2}\right]\left[\frac{-\bar{P}_{i-1} + \bar{P}_{i+1}}{2\Delta\bar{x}}\right] = \frac{B + 2Ci\Delta\bar{x}}{(A + Bi\,\Delta\bar{x} + C(i\Delta\bar{x})^2)^3}$$

Rearranging (A14), we obtain (A15):

$$\frac{\bar{P}_{i-1}}{\Delta\bar{x}^2}\left[\frac{3(B + 2Ci\Delta\bar{x})}{2\Delta\bar{x}(A + Bi\,\Delta\bar{x} + C(i\Delta\bar{x})^2)}\right] - \frac{2\bar{P}_i}{\Delta\bar{x}^2} + \frac{\bar{P}_{i+1}}{\Delta\bar{x}^2}\left[\frac{3(B + 2Ci\Delta\bar{x})}{2\Delta\bar{x}(A + Bi\,\Delta\bar{x} + C(i\Delta\bar{x})^2)}\right] = \frac{B + 2Ci\Delta\bar{x}}{(A + Bi\,\Delta\bar{x} + C(i\Delta\bar{x})^2)^3}$$

Equation (A15) is solved by computer program Pressure.c using standard matrix operations. The output of Pressure.c is a file which contains the non-dimensional pressure calculated at 200 points along the wetted width. When plotted, this file is a graphic representation of the pressure distribution under the ring. The area under this distribution is defined as the bearing number and is discussed at length in §2. The pressure distribution is also used to calculate shear stress and drag on the ring.

The C-language code begins on the following page.

```
/*****
*
*       Pressure.c
*
*       This program solves the a finite difference approximation to the
*       1-D Reynolds equation.  The program uses a polynomial fit of the actual
*       film thickness data taken.  (h = A + Bx + Cx^2). Prior to running this
*       program, the film trace must already be non-dimensionalized in
*       accordance with the specified parameters.  This allows for input of
*       the coefficients A,B, and C to be non-dimensional.
*
*       As an aide to interpreting the code, the following is provided:
*       - a is the array for the diagonal elements for the coefficient matrix.
*       - b is the Array for the elements below the diagonal and c is the one *
        above.
*       - alpha and beta are dummy arrays used in solving the equation
*       - f is the constant array.  Results are returned in array X.
*       - m is the order of the system.
*       - dx is the increment in the x direction.  (xi=i*dx)
*
*       NOTE:  all variables have been non-dimensionalized
*                       h is divided by the minimum thickness, ho
*                       x is divided by the wetted width, w
*                       P is divided by 6μUb and multiplied by ho^2
*
*                       The resulting equation is:
*
*                       ∂/∂x (h3*∂P/∂x) = ∂h/∂x                 Eqn (6)
*
******/

#define _ERRORCHECK_    /*  for standard error checking */

#include <stdio.h>
#include <math.h>

#define ndm (201)

FILE *fp1;
double          alpha[ndm], beta[ndm], y[ndm];
double          a[ndm], b[ndm], c[ndm], f[ndm], x[ndm];
double          dx, xi, A, B, C, sum;
double          P1, P2, mu, U, w,h;
short   m, i;

main()
{
        fp1 = fopen("aaPressure.txt", "w");

        printf("\nPlease input the crown land pressure (Pa) \n");
        scanf("%lf", &P1);
        printf("\nPlease input the second land pressure (Pa) \n");
        scanf("%lf", &P2);
        printf("\nPlease input the oil viscosity (Pa*s) \n");
```

```
scanf("%lf", &mu);
printf("\nPlease input the ring velocity (m/s) \n");
scanf("%lf", &U);
printf("\nPlease input the wetted ring width (m) \n");
scanf("%lf", &w);
printf("\%nPlease input the minimum film thickness (m)\n");
scanf("%lf",&h);
printf("\n\nh(x) = A + Bx + Cx^2\n");
printf("\nPlease input A\n");
scanf("%lf", &A);
printf("\nPlease input B\n");
scanf("%lf", &B);
printf("\nPlease input C\n");
scanf("%lf", &C);

m = 200;
dx = 1.0/m;

for (i=1; i<=(m-1); i++)
{
        xi=i*dx;
        b[i] = 1.0-(3.0*(B+2.*C*xi)*dx)/(2.0*(A+B*xi+C*pow(xi,2)));     /*
Pi-1 */
        a[i] = -2.0;
    /*Pi*/
        c[i] = 1.0+(3.0*(B+2.*C*xi)*dx)/(2.0*(A+B*xi+C*pow(xi,2))); /*
Pi+1 */
        f[i] = ((B+2.*C*xi)*pow(dx,2))/(pow(A+B*xi+C*pow(xi,2),3));
}

a[0] = 1.0;                          /* Initial conditions are that P1 = Pcl */
a[m] = 1.0;                          /* and P2 = Psl */
b[0] = 0.0;
b[m] = 0.0;
c[0] = 0.0;
c[m] = 0.0;
f[0] = P1*pow(h,2)/(6*mu*U*w);                  /*crown land pressure */

f[m] = P2*pow(h,2)/(6*mu*U*w);                  /*2nd land pressure */


alpha[0] = a[0];
for (i=1; i<=m; i++)
{
        beta[i] = b[i]/alpha[i-1];
        alpha[i] = a[i] - beta[i]*c[i-1];
}
y[0] = f[0];
for (i=1; i<=m; i++)
{
        y[i] = f[i] - beta[i]*y[i-1];
}
x[m] = y[m]/alpha[m];
for (i=m-1; i>=0; i--)
```

```
	{
		x[i] = (y[i] - c[i]*x[i+1])/alpha[i];
	}

	for (i=0; i<=m; i++) sum = sum + x[i];
	sum = (sum-.5*x[0]-.5*x[m])*dx;	/*	trapezoidal integration */

	fprintf(fp1, "%e\t%e\tW*        = %f\n", 0.0*dx, x[0], sum);
	fprintf(fp1, "%e\t%e\tU(m/s)    = %f\n", 1.0*dx, x[1], U);
	fprintf(fp1, "%e\t%e\tmu(Pa*s)  = %f\n", 2.0*dx, x[2], mu);
	fprintf(fp1, "%e\t%e\tPcrown    = %f\n", 3.0*dx, x[3], P1);
	fprintf(fp1, "%e\t%e\tP2ndland  = %f\n", 4.0*dx, x[4], P2);
	fprintf(fp1, "%e\t%e\tw(m)      = %f\n", 5.0*dx, x[5], w);
	fprintf(fp1, "%e\t%e\tA         = %f\n", 6.0*dx, x[7], A);
	fprintf(fp1, "%e\t%e\tB         = %f\n", 7.0*dx, x[8], B);
	fprintf(fp1, "%e\t%e\tC         = %f\n", 8.0*dx, x[9], C);

	for (i=9; i<=m; i++) fprintf(fp1, "%e\t%e\n", i*dx, x[i]);
	for (i=0; i<=m; i++) printf("%e\t%e\n", i*dx, x[i]);

	printf("W* = %lf\n", sum);		/*	sum represents the non dim.
lift/length */

	fclose(fp1);
}
```

APPENDIX B - Exhaust Stroke Spreadsheet

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | #201 Cummins 15W40 Motored 1000 rpm | | | | | | | |
| 2 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 3 | Exh-2 | 0.242354 | 10.948 | 0.1154 | 0.20084 | 11.94 | 0.126954 | 0.992 |
| 4 | Exh-4 | 0.18071 | 10.907 | 0.13921 | 0.20512 | 11.915 | 0.0415 | 1.008 |
| 5 | Exh-6 | 0.19028 | 10.909 | 0.11948 | 0.19028 | 11.883 | 0.0708 | 0.974 |
| 6 | Exh-8 | 0.19632 | 10.984 | 0.13285 | 0.2183 | 11.915 | 0.06347 | 0.931 |
| 7 | Exh-10 | 0.19712 | 10.948 | 0.14341 | 0.20689 | 11.883 | 0.05371 | 0.935 |
| 8 | Exh-12 | 0.19364 | 10.888 | 0.13993 | 0.19852 | 11.876 | 0.05371 | 0.988 |
| 9 | Exh-14 | 0.17981 | 10.948 | 0.12855 | 0.21155 | 11.845 | 0.05126 | 0.897 |
| 10 | | | | | | | | |
| 11 | #202 Cummins 15W40 Motored 1500 rpm | | | | | | | |
| 12 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 13 | Exh-2 | 0.13536 | 11.31 | 0.10118 | 0.11583 | 12.003 | 0.03418 | 0.693 |
| 14 | Exh-8 | 0.16418 | 11.281 | 0.10732 | 0.11709 | 12.03 | 0.05686 | 0.749 |
| 15 | Exh-10 | 0.13466 | 11.31 | 0.10048 | 0.15175 | 12.003 | 0.03418 | 0.693 |
| 16 | Exh-12 | 0.12661 | 11.281 | 0.089992 | 0.13638 | 12.005 | 0.036618 | 0.724 |
| 17 | Exh-14 | 0.12577 | 11.281 | 0.091587 | 0.12333 | 12.03 | 0.034183 | 0.749 |
| 18 | Exh-20 | 0.11503 | 11.338 | 0.088179 | 0.11992 | 12.057 | 0.026851 | 0.719 |
| 19 | Exh-22 | 0.1655 | 11.281 | 0.11424 | 0.1533 | 12.087 | 0.05126 | 0.806 |
| 20 | | | | | | | | |
| 21 | #203 Cummins 15W40 Motored 2000 rpm | | | | | | | |
| 22 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 23 | Exh-1 | 0.14003 | 11.222 | 0.10585 | 0.15223 | 11.876 | 0.03418 | 0.654 |
| 24 | Exh-3 | 0.13075 | 11.147 | 0.10389 | 0.17225 | 11.915 | 0.02686 | 0.768 |
| 25 | Exh-5 | 0.13667 | 11.147 | 0.095164 | 0.17573 | 11.927 | 0.041506 | 0.78 |
| 26 | Exh-9 | 0.14663 | 11.147 | 0.095358 | 0.17348 | 11.89 | 0.051272 | 0.743 |
| 27 | Exh-13 | 0.13952 | 11.147 | 0.11511 | 0.14684 | 11.853 | 0.02441 | 0.706 |
| 28 | Exh-15 | 0.13382 | 11.036 | 0.084998 | 0.15335 | 11.89 | 0.048822 | 0.854 |
| 29 | Exh-19 | 0.15059 | 10.889 | 0.10909 | 0.14327 | 11.63 | 0.0415 | 0.741 |
| 30 | Exh-21 | 0.13802 | 10.961 | 0.098959 | 0.11849 | 11.667 | 0.039061 | 0.706 |
| 31 | Exh-23 | 0.21336 | 10.887 | 0.15506 | 0.18924 | 11.89 | 0.0583 | 1.003 |
| 32 | Exh-25 | 0.1504 | 11.087 | 0.094246 | 0.13331 | 11.816 | 0.056154 | 0.729 |
| 33 | Exh-27 | 0.1422 | 11.147 | 0.11779 | 0.14709 | 11.89 | 0.02441 | 0.743 |
| 34 | | | | | | | | |
| 35 | #204 Cummins 15W40 Motored 2500 rpm | | | | | | | |
| 36 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 37 | Exh-2 | 0.11457 | 11.301 | 0.092603 | 0.15608 | 12.015 | 0.021967 | 0.714 |
| 38 | Exh-4 | 0.11571 | 11.19 | 0.083973 | 0.14989 | 12.015 | 0.031737 | 0.825 |
| 39 | Exh-6 | 0.11513 | 11.301 | 0.090717 | 0.14443 | 12.015 | 0.024413 | 0.714 |
| 40 | Exh-10 | 0.13345 | 11.211 | 0.099274 | 0.17496 | 12.015 | 0.034176 | 0.804 |
| 41 | Exh-12 | 0.1234 | 11.239 | 0.098984 | 0.11363 | 11.977 | 0.024416 | 0.738 |
| 42 | Exh-14 | 0.11167 | 11.142 | 0.09726 | 0.11656 | 11.842 | 0.01441 | 0.7 |
| 43 | Exh-16 | 0.13623 | 11.287 | 0.11914 | 0.11945 | 11.967 | 0.01709 | 0.68 |
| 44 | Exh-22 | 0.10718 | 11.239 | 0.087647 | 0.16089 | 12.067 | 0.019533 | 0.828 |
| 45 | Exh-24 | 0.11646 | 11.336 | 0.10425 | 0.1482 | 12.015 | 0.01221 | 0.679 |
| 46 | Exh-28 | 0.113 | 11.336 | 0.091031 | 0.14718 | 12.0115 | 0.021969 | 0.6755 |
| 47 | Exh-30 | 0.14 | 11.287 | 0.12291 | 0.15709 | 11.977 | 0.01709 | 0.69 |
| 48 | Exh-34 | 0.11893 | 11.239 | 0.079863 | 0.10428 | 11.932 | 0.039067 | 0.693 |
| 49 | | | | | | | | |
| 50 | | | | | | | | |
| 51 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 52 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 53 | Exh-1 | 0.17433 | 10.645 | 0.066907 | 0.07179 | 11.697 | 0.107423 | 1.052 |
| 54 | Exh-3 | 0.25487 | 10.608 | 0.093738 | 0.11327 | 11.82 | 0.161132 | 1.212 |
| 55 | Exh-5 | 0.21506 | 10.683 | 0.1052 | 0.16867 | 11.783 | 0.10986 | 1.1 |
| 56 | Exh-7 | 0.21946 | 10.602 | 0.077857 | 0.1096 | 11.774 | 0.141603 | 1.172 |
| 57 | Exh-9 | 0.18296 | 10.602 | 0.077978 | 0.11216 | 11.832 | 0.104982 | 1.23 |
| 58 | Exh-11 | 0.2517 | 10.608 | 0.085689 | 0.13452 | 11.812 | 0.166011 | 1.204 |
| 59 | Exh-13 | 0.22301 | 10.608 | 0.074086 | 0.096059 | 11.802 | 0.148924 | 1.194 |
| 60 | Exh-15 | 0.23208 | 10.608 | 0.073385 | 0.092916 | 11.774 | 0.158695 | 1.166 |
| 61 | | | | | | | | |
| 62 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 63 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 64 | Exh-3 | 0.16239 | 10.727 | 0.072056 | 0.091587 | 11.8252 | 0.090334 | 1.0982 |
| 65 | Exh-7 | 0.15772 | 10.582 | 0.060066 | 0.08448 | 11.558 | 0.097654 | 0.976 |
| 66 | Exh-9 | 0.15149 | 10.758 | 0.063595 | 0.095334 | 11.736 | 0.087895 | 0.978 |
| 67 | Exh-11 | 0.16952 | 10.814 | 0.091394 | 0.10604 | 11.764 | 0.078126 | 0.95 |
| 68 | Exh-13 | 0.17015 | 10.786 | 0.072491 | 0.11399 | 11.778 | 0.097659 | 0.992 |
| 69 | Exh-15 | 0.15591 | 10.727 | 0.086226 | 0.10952 | 11.822 | 0.069684 | 1.095 |
| 70 | Exh-17 | 0.19408 | 10.785 | 0.072007 | 0.084214 | 11.793 | 0.122073 | 1.008 |
| 71 | Exh-19 | 0.1619 | 10.796 | 0.071572 | 0.093545 | 11.707 | 0.090328 | 0.911 |
| 72 | Exh-21 | 0.16623 | 10.525 | 0.066133 | 0.071016 | 11.793 | 0.100097 | 1.268 |
| 73 | | | | | | | | |

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 74 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 75 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 76 | Exh-1 | 0.13742 | 10.655 | 0.078824 | 0.08859 | 11.857 | 0.058596 | 1.202 |
| 77 | Exh-7 | 0.13217 | 10.739 | 0.095551 | 0.1102 | 11.646 | 0.036619 | 0.907 |
| 78 | Exh-9 | 0.14747 | 10.774 | 0.098645 | 0.10597 | 11.597 | 0.048825 | 0.823 |
| 79 | Exh-13 | 0.15376 | 10.664 | 0.092723 | 0.11225 | 11.709 | 0.061037 | 1.045 |
| 80 | Exh-17 | 0.12922 | 10.776 | 0.099926 | 0.11457 | 11.606 | 0.029294 | 0.83 |
| 81 | Exh-21 | 0.12543 | 10.701 | 0.0766 | 0.081483 | 11.646 | 0.04883 | 0.945 |
| 82 | Exh-25 | 0.15941 | 10.739 | 0.135 | 0.15209 | 11.527 | 0.02441 | 0.788 |
| 83 | Exh-27 | 0.11484 | 10.739 | 0.083102 | 0.087985 | 11.671 | 0.031738 | 0.932 |
| 84 | | | | | | | | |
| 85 | #301 MOBIL 1 MOTORED 1000 RPM | | | | | | | |
| 86 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 87 | Exh-1 | 0.24849 | 10.673 | 0.082474 | 0.11177 | 11.562 | 0.166016 | 0.889 |
| 88 | Exh-3 | 0.25151 | 10.717 | 0.10014 | 0.14182 | 11.83 | 0.15137 | 1.113 |
| 89 | Exh-5 | 0.25168 | 10.698 | 0.09543 | 0.14182 | 11.83 | 0.15625 | 1.132 |
| 90 | Exh-7 | 0.2665 | 10.698 | 0.10537 | 0.13466 | 11.849 | 0.16113 | 1.151 |
| 91 | Exh-9 | 0.21982 | 10.698 | 0.10508 | 0.15146 | 11.864 | 0.11474 | 1.166 |
| 92 | Exh-11 | 0.25615 | 10.71 | 0.10967 | 0.14141 | 11.827 | 0.14648 | 1.117 |
| 93 | Exh-13 | 0.24588 | 10.729 | 0.099395 | 0.21902 | 11.864 | 0.146485 | 1.135 |
| 94 | Exh-15 | 0.186 | 10.737 | 0.10788 | 0.19089 | 11.83 | 0.07812 | 1.093 |
| 95 | | | | | | | | |
| 96 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 97 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 98 | Exh-1 | 0.22146 | 10.871 | 0.12381 | 0.14822 | 11.878 | 0.09765 | 1.007 |
| 99 | Exh-3 | 0.21665 | 10.525 | 0.1167 | 0.18736 | 11.673 | 0.09995 | 1.148 |
| 100 | Exh-5 | 0.24757 | 10.641 | 0.13527 | 0.16456 | 11.734 | 0.1123 | 1.093 |
| 101 | Exh-7 | 0.21383 | 10.612 | 0.11861 | 0.16988 | 11.762 | 0.09522 | 1.15 |
| 102 | Exh-9 | 0.22746 | 10.554 | 0.10783 | 0.14201 | 11.763 | 0.11963 | 1.209 |
| 103 | Exh-11 | 0.22349 | 10.612 | 0.14781 | 0.16281 | 11.762 | 0.07568 | 1.15 |
| 104 | Exh-13 | 0.24588 | 10.554 | 0.11648 | 0.1531 | 11.734 | 0.1294 | 1.18 |
| 105 | Exh-17 | 0.21165 | 10.641 | 0.10911 | 0.17015 | 11.792 | 0.10254 | 1.151 |
| 106 | Exh-19 | 0.2424 | 10.633 | 0.14718 | 0.1716 | 11.677 | 0.09522 | 1.044 |
| 107 | | | | | | | | |
| 108 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 109 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 110 | Exh-1 | 0.20703 | 10.586 | 0.10694 | 0.15332 | 11.697 | 0.10009 | 1.111 |
| 111 | Exh-3 | 0.20203 | 10.507 | 0.10926 | 0.15076 | 11.623 | 0.09277 | 1.116 |
| 112 | Exh-5 | 0.22422 | 10.579 | 0.1461 | 0.17051 | 11.734 | 0.07812 | 1.155 |
| 113 | Exh-7 | 0.18603 | 10.43 | 0.1079 | 0.14696 | 11.623 | 0.07813 | 1.193 |
| 114 | Exh-9 | 0.23232 | 10.505 | 0.098041 | 0.18105 | 11.655 | 0.134279 | 1.15 |
| 115 | Exh-11 | 0.20292 | 10.467 | 0.11992 | 0.14677 | 11.66 | 0.083 | 1.193 |
| 116 | Exh-13 | 0.19217 | 10.542 | 0.11404 | 0.14822 | 11.66 | 0.07813 | 1.118 |
| 117 | Exh-17 | 0.18902 | 10.43 | 0.10358 | 0.15729 | 11.655 | 0.08544 | 1.225 |
| 118 | Exh-19 | 0.19224 | 10.547 | 0.11656 | 0.15328 | 11.66 | 0.07568 | 1.113 |
| 119 | Exh-21 | 0.1825 | 10.579 | 0.09705 | 0.14344 | 11.66 | 0.08545 | 1.081 |
| 120 | Exh-23 | 0.19898 | 10.547 | 0.11598 | 0.15748 | 11.695 | 0.083 | 1.148 |
| 121 | Exh-25 | 0.1957 | 10.507 | 0.13222 | 0.1664 | 11.697 | 0.06348 | 1.19 |
| 122 | Exh-27 | 0.20338 | 10.547 | 0.13014 | 0.16676 | 11.66 | 0.07324 | 1.113 |
| 123 | | | | | | | | |
| 124 | #352 PENNZOIL 15W40 MOTORED 1500 RPM | | | | | | | |
| 125 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 126 | Exh-1 | 0.17892 | 10.419 | 0.13986 | 0.1716 | 11.417 | 0.03906 | 0.998 |
| 127 | Exh-3 | 0.25557 | 10.473 | 0.16524 | 0.19209 | 11.377 | 0.09033 | 0.904 |
| 128 | Exh-5 | 0.19183 | 10.386 | 0.12347 | 0.15765 | 11.388 | 0.06836 | 1.002 |
| 129 | Exh-7 | 0.22207 | 10.415 | 0.13662 | 0.19033 | 11.445 | 0.08545 | 1.03 |
| 130 | Exh-11 | 0.19811 | 10.358 | 0.14196 | 0.19567 | 11.35 | 0.05615 | 0.992 |
| 131 | Exh-13 | 0.19456 | 10.415 | 0.14085 | 0.17259 | 11.36 | 0.05371 | 0.945 |
| 132 | Exh-15 | 0.22045 | 10.282 | 0.13256 | 0.22289 | 11.217 | 0.08789 | 0.935 |
| 133 | Exh-17 | 0.21426 | 10.358 | 0.1459 | 0.17032 | 11.331 | 0.06836 | 0.973 |
| 134 | Exh-19 | 0.18682 | 10.473 | 0.12335 | 0.15997 | 11.35 | 0.06347 | 0.877 |
| 135 | Exh-21 | 0.1787 | 10.415 | 0.10546 | 0.12499 | 11.455 | 0.07324 | 1.04 |
| 136 | | | | | | | | |
| 137 | #353 PENNZOIL 15W40 MOTORED 2000 RPM | | | | | | | |
| 138 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 139 | Exh-1 | 0.15175 | 10.464 | 0.10781 | 0.15175 | 11.289 | 0.04394 | 0.825 |
| 140 | Exh-3 | 0.15668 | 10.464 | 0.088324 | 0.14936 | 11.427 | 0.068356 | 0.963 |
| 141 | Exh-5 | 0.14974 | 10.464 | 0.12289 | 0.14974 | 11.365 | 0.02685 | 0.901 |
| 142 | Exh-9 | 0.14544 | 10.462 | 0.1137 | 0.16497 | 11.353 | 0.03174 | 0.891 |
| 143 | Exh-11 | 0.15332 | 10.304 | 0.11078 | 0.14112 | 10.983 | 0.04254 | 0.679 |
| 144 | Exh-13 | 0.15032 | 10.538 | 0.12591 | 0.16986 | 11.316 | 0.02441 | 0.778 |
| 145 | Exh-15 | 0.16229 | 10.304 | 0.12567 | 0.13543 | 11.131 | 0.03662 | 0.827 |
| 146 | Exh-17 | 0.1744 | 10.315 | 0.13534 | 0.14754 | 11.168 | 0.03906 | 0.853 |

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 147 | Exh-19 | 0.18064 | 10.353 | 0.12937 | 0.14402 | 11.131 | 0.05127 | 0.778 |
| 148 | Exh-21 | 0.18267 | 10.353 | 0.11675 | 0.13872 | 11.094 | 0.06592 | 0.741 |
| 149 | Exh-23 | 0.15912 | 10.304 | 0.1225 | 0.13959 | 11.094 | 0.03662 | 0.79 |
| 150 | Exh-25 | 0.19067 | 10.241 | 0.14184 | 0.15161 | 11.092 | 0.04883 | 0.851 |
| 151 | Exh-27 | 0.15509 | 10.501 | 0.12335 | 0.15509 | 11.316 | 0.03174 | 0.815 |
| 152 | | | | | | | | |
| 153 | #401 Pennzoil SAE30 Motored 1000 rpm | | | | | | | |
| 154 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 155 | Exh-1 | 0.21523 | 10.543 | 0.10292 | 0.16396 | 11.594 | 0.11231 | 1.051 |
| 156 | Exh-3 | 0.2119 | 10.486 | 0.10377 | 0.18678 | 11.646 | 0.10813 | 1.16 |
| 157 | Exh-5 | 0.19529 | 10.486 | 0.10007 | 0.16599 | 11.651 | 0.09522 | 1.165 |
| 158 | Exh-7 | 0.19103 | 10.59 | 0.10802 | 0.16174 | 11.651 | 0.08301 | 1.061 |
| 159 | Exh-9 | 0.20544 | 10.404 | 0.10046 | 0.15173 | 11.628 | 0.10498 | 1.224 |
| 160 | Exh-11 | 0.21225 | 10.478 | 0.10483 | 0.16587 | 11.575 | 0.10742 | 1.097 |
| 161 | Exh-13 | 0.20396 | 10.582 | 0.11607 | 0.16002 | 11.575 | 0.08789 | 0.993 |
| 162 | Exh-15 | 0.22258 | 10.524 | 0.12492 | 0.14933 | 11.651 | 0.09766 | 1.127 |
| 163 | | | | | | | | |
| 164 | #402 Pennzoil SAE30 Motored 1500 rpm | | | | | | | |
| 165 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 166 | Exh-2 | 0.23771 | 10.361 | 0.1132 | 0.1254 | 11.566 | 0.12451 | 1.205 |
| 167 | Exh-4 | 0.22869 | 10.361 | 0.12615 | 0.15057 | 11.535 | 0.10254 | 1.174 |
| 168 | Exh-6 | 0.25506 | 10.361 | 0.11102 | 0.16229 | 11.48 | 0.14404 | 1.119 |
| 169 | Exh-8 | 0.23701 | 10.41 | 0.13447 | 0.15888 | 11.566 | 0.10254 | 1.156 |
| 170 | Exh-10 | 0.22659 | 10.419 | 0.12161 | 0.13626 | 11.508 | 0.10498 | 1.089 |
| 171 | Exh-12 | 0.23121 | 10.448 | 0.12623 | 0.15552 | 11.562 | 0.10498 | 1.114 |
| 172 | Exh-14 | 0.23623 | 10.361 | 0.12393 | 0.15323 | 11.453 | 0.1123 | 1.092 |
| 173 | Exh-16 | 0.26062 | 10.361 | 0.12146 | 0.16053 | 11.535 | 0.13916 | 1.174 |
| 174 | Exh-18 | 0.21745 | 10.332 | 0.11735 | 0.13689 | 11.48 | 0.1001 | 1.148 |
| 175 | Exh-20 | 0.24249 | 10.355 | 0.11798 | 0.1424 | 11.566 | 0.12451 | 1.211 |
| 176 | Exh-22 | 0.25057 | 10.438 | 0.13338 | 0.17733 | 11.508 | 0.11719 | 1.07 |
| 177 | | | | | | | | |
| 178 | #403 Pennzoil SAE30 Motored 2000 rpm | | | | | | | |
| 179 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 180 | Exh-2 | 0.22306 | 10.478 | 0.12785 | 0.14493 | 11.48 | 0.09521 | 1.002 |
| 181 | Exh-4 | 0.2351 | 10.329 | 0.13012 | 0.13256 | 11.48 | 0.10498 | 1.151 |
| 182 | Exh-6 | 0.21092 | 10.257 | 0.12304 | 0.14012 | 11.48 | 0.08788 | 1.223 |
| 183 | Exh-8 | 0.2327 | 10.366 | 0.10819 | 0.11308 | 11.48 | 0.12451 | 1.114 |
| 184 | Exh-10 | 0.21276 | 10.366 | 0.13708 | 0.15173 | 11.554 | 0.07568 | 1.188 |
| 185 | Exh-12 | 0.24506 | 10.366 | 0.1059 | 0.15228 | 11.517 | 0.13916 | 1.151 |
| 186 | Exh-14 | 0.24745 | 10.292 | 0.14491 | 0.15468 | 11.441 | 0.10254 | 1.149 |
| 187 | Exh-18 | 0.19243 | 10.366 | 0.1314 | 0.16558 | 11.48 | 0.06103 | 1.114 |
| 188 | Exh-22 | 0.2475 | 10.404 | 0.12787 | 0.15228 | 11.443 | 0.11963 | 1.039 |
| 189 | Exh-24 | 0.21803 | 10.366 | 0.10573 | 0.13258 | 11.558 | 0.1123 | 1.192 |
| 190 | Exh-26 | 0.23677 | 10.297 | 0.12934 | 0.15376 | 11.517 | 0.10743 | 1.22 |
| 191 | Exh-28 | 0.25613 | 10.366 | 0.10476 | 0.13406 | 11.48 | 0.15137 | 1.114 |
| 192 | | | | | | | | |
| 193 | #404 Pennzoil SAE30 Motored 2500 rpm | | | | | | | |
| 194 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 195 | Exh-3 | 0.17068 | 10.579 | 0.12673 | 0.16335 | 11.48 | 0.04395 | 0.901 |
| 196 | Exh-5 | 0.18617 | 10.534 | 0.13979 | 0.18373 | 11.49 | 0.04638 | 0.956 |
| 197 | Exh-9 | 0.18982 | 10.443 | 0.13611 | 0.17762 | 11.383 | 0.05371 | 0.94 |
| 198 | Exh-17 | 0.19173 | 10.443 | 0.16976 | 0.19173 | 11.528 | 0.02197 | 1.085 |
| 199 | Exh-19 | 0.2182 | 10.558 | 0.16937 | 0.19135 | 11.57 | 0.04883 | 1.012 |
| 200 | Exh-21 | 0.18941 | 10.412 | 0.11851 | 0.12838 | 11.625 | 0.0709 | 1.213 |
| 201 | Exh-23 | 0.21665 | 10.461 | 0.16783 | 0.18247 | 11.48 | 0.04882 | 1.019 |
| 202 | Exh-27 | 0.16079 | 10.558 | 0.13638 | 0.18275 | 11.48 | 0.02441 | 0.922 |

| | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|
| 1 | #201 Cummins 15W40 Motored 1000 rpm | | | | | | | |
| 2 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 3 | Exh-2 | 32.7 | 3.882385321 | 3.529051988 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 4 | Exh-4 | 32.7 | 1.26911315 | 4.257186544 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 5 | Exh-6 | 32.7 | 2.165137615 | 3.65382263 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 6 | Exh-8 | 32.7 | 1.940978593 | 4.062691131 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 7 | Exh-10 | 32.7 | 1.642507645 | 4.385626911 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 8 | Exh-12 | 32.7 | 1.642507645 | 4.279204893 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 9 | Exh-14 | 32.7 | 1.567584098 | 3.931192661 | 220025 | 73 | 17.05520631 | 0.017055206 |
| 10 | | | | | | | | |
| 11 | #202 Cummins 15W40 Motored 1500 rpm | | | | | | | |
| 12 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 13 | Exh-2 | 32.7 | 1.045259939 | 3.094189602 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 14 | Exh-8 | 32.7 | 1.73883792 | 3.281957187 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 15 | Exh-10 | 32.7 | 1.045259939 | 3.072782875 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 16 | Exh-12 | 32.7 | 1.119816514 | 2.75204893 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 17 | Exh-14 | 32.7 | 1.045351682 | 2.800825688 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 18 | Exh-20 | 32.7 | 0.821131498 | 2.696605505 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 19 | Exh-22 | 32.7 | 1.567584098 | 3.493577982 | 220025 | 83.3 | 12.98359739 | 0.012983597 |
| 20 | | | | | | | | |
| 21 | #203 Cummins 15W40 Motored 2000 rpm | | | | | | | |
| 22 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 23 | Exh-1 | 32.7 | 1.045259939 | 3.237003058 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 24 | Exh-3 | 32.7 | 0.821406728 | 3.17706422 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 25 | Exh-5 | 32.7 | 1.269296636 | 2.910214067 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 26 | Exh-9 | 32.7 | 1.56795107 | 2.916146789 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 27 | Exh-13 | 32.7 | 0.74648318 | 3.520183486 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 28 | Exh-15 | 32.7 | 1.493027523 | 2.599327217 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 29 | Exh-19 | 32.7 | 1.26911315 | 3.336085627 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 30 | Exh-21 | 32.7 | 1.194525994 | 3.026269113 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 31 | Exh-23 | 32.7 | 1.782874618 | 4.741896024 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 32 | Exh-25 | 32.7 | 1.717247706 | 2.882140673 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 33 | Exh-27 | 32.7 | 0.74648318 | 3.602140673 | 220025 | 92.7 | 10.40957555 | 0.010409576 |
| 34 | | | | | | | | |
| 35 | #204 Cummins 15W40 Motored 2500 rpm | | | | | | | |
| 36 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 37 | Exh-2 | 32.7 | 0.6717737 | 2.831896024 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 38 | Exh-4 | 32.7 | 0.970550459 | 2.567981651 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 39 | Exh-6 | 32.7 | 0.746574924 | 2.774220183 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 40 | Exh-10 | 32.7 | 1.045137615 | 3.035902141 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 41 | Exh-12 | 32.7 | 0.746666667 | 3.027033639 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 42 | Exh-14 | 32.7 | 0.440672783 | 2.974311927 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 43 | Exh-16 | 32.7 | 0.522629969 | 3.643425076 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 44 | Exh-22 | 32.7 | 0.59733945 | 2.680336391 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 45 | Exh-24 | 32.7 | 0.373394495 | 3.188073394 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 46 | Exh-28 | 32.7 | 0.671834862 | 2.78382263 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 47 | Exh-30 | 32.7 | 0.522629969 | 3.758715596 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 48 | Exh-34 | 32.7 | 1.19470948 | 2.442293578 | 220025 | 101.3 | 8.665777225 | 0.008665777 |
| 49 | | | | | | | | |
| 50 | | | | | | | | |
| 51 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 52 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 53 | Exh-1 | 35.6 | 3.0175 | 1.879410112 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 54 | Exh-3 | 35.6 | 4.526179775 | 2.633089888 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 55 | Exh-5 | 35.6 | 3.085955056 | 2.95505618 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 56 | Exh-7 | 35.6 | 3.97761236 | 2.186994382 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 57 | Exh-9 | 35.6 | 2.948932584 | 2.190393258 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 58 | Exh-11 | 35.6 | 4.663230337 | 2.406994382 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 59 | Exh-13 | 35.6 | 4.183258427 | 2.081067416 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 60 | Exh-15 | 35.6 | 4.457724719 | 2.061376404 | 220025 | 73 | 17.10375498 | 0.017103755 |
| 61 | | | | | | | | |
| 62 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 63 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 64 | Exh-3 | 35.6 | 2.53747191 | 2.024044944 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 65 | Exh-7 | 35.6 | 2.743089888 | 1.687247191 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 66 | Exh-9 | 35.6 | 2.468960674 | 1.786376404 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 67 | Exh-11 | 35.6 | 2.194550562 | 2.567247191 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 68 | Exh-13 | 35.6 | 2.743230337 | 2.036264045 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 69 | Exh-15 | 35.6 | 1.95741573 | 2.422078652 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 70 | Exh-17 | 35.6 | 3.429016854 | 2.022668539 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 71 | Exh-19 | 35.6 | 2.537303371 | 2.010449438 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 72 | Exh-21 | 35.6 | 2.811713483 | 1.857668539 | 220025 | 83.3 | 12.5655416 | 0.012565542 |
| 73 | | | | | | | | |

| | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|
| 74 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 75 | Stroke/rev | Cal (mV/µm) | Delta (µm) | h min (µm) | ΔP (Pa) | Oil Temp (°C) | µ (CP) | µ (Pa-s) |
| 76 | Exh-1 | 35.6 | 1.645955056 | 2.214157303 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 77 | Exh-7 | 35.6 | 1.028623596 | 2.684016854 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 78 | Exh-9 | 35.6 | 1.371488764 | 2.770926966 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 79 | Exh-13 | 35.6 | 1.714522472 | 2.604578652 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 80 | Exh-17 | 35.6 | 0.822865169 | 2.806910112 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 81 | Exh-21 | 35.6 | 1.371629213 | 2.151685393 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 82 | Exh-25 | 35.6 | 0.685674157 | 3.792134831 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 83 | Exh-27 | 35.6 | 0.891516854 | 2.334325843 | 220025 | 92.7 | 9.788249549 | 0.00978825 |
| 84 | | | | | | | | |
| 85 | #301 MOBIL 1 MOTORED 1000 RPM | | | | | | | |
| 86 | Stroke/rev | Cal (mV/µm) | Delta (µm) | h min (µm) | ΔP (Pa) | Oil Temp (°C) | µ (CP) | µ (Pa-s) |
| 87 | Exh-1 | 33.8 | 4.911715976 | 2.440059172 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 88 | Exh-3 | 33.8 | 4.478402367 | 2.962721893 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 89 | Exh-5 | 33.8 | 4.622781065 | 2.823372781 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 90 | Exh-7 | 33.8 | 4.767159763 | 3.117455621 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 91 | Exh-9 | 33.8 | 3.394674556 | 3.10887574 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 92 | Exh-11 | 33.8 | 4.333727811 | 3.244674556 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 93 | Exh-13 | 33.8 | 4.33387574 | 2.940680473 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 94 | Exh-15 | 33.8 | 2.311242604 | 3.191715976 | 220025 | 73 | 20.98534438 | 0.020985344 |
| 95 | | | | | | | | |
| 96 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 97 | Stroke/rev | Cal (mV/µm) | Delta (µm) | h min (µm) | ΔP (Pa) | Oil Temp (°C) | µ (CP) | µ (Pa-s) |
| 98 | Exh-1 | 33.8 | 2.889053254 | 3.663017751 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 99 | Exh-3 | 33.8 | 2.957100592 | 3.452662722 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 100 | Exh-5 | 33.8 | 3.322485207 | 4.002071006 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 101 | Exh-7 | 33.8 | 2.817159763 | 3.509171598 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 102 | Exh-9 | 33.8 | 3.539349112 | 3.190236686 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 103 | Exh-11 | 33.8 | 2.239053254 | 4.373076923 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 104 | Exh-13 | 33.8 | 3.828402367 | 3.446153846 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 105 | Exh-17 | 33.8 | 3.033727811 | 3.228106509 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 106 | Exh-19 | 33.8 | 2.817159763 | 4.35443787 | 220025 | 83.3 | 15.88381858 | 0.015883819 |
| 107 | | | | | | | | |
| 108 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 109 | Stroke/rev | Cal (mV/µm) | Delta (µm) | h min (µm) | ΔP (Pa) | Oil Temp (°C) | µ (CP) | µ (Pa-s) |
| 110 | Exh-1 | 33.8 | 2.961242604 | 3.163905325 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 111 | Exh-3 | 33.8 | 2.744674556 | 3.232544379 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 112 | Exh-5 | 33.8 | 2.311242604 | 4.322485207 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 113 | Exh-7 | 33.8 | 2.311538462 | 3.192307692 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 114 | Exh-9 | 33.8 | 3.972751479 | 2.900621302 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 115 | Exh-11 | 33.8 | 2.455621302 | 3.547928994 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 116 | Exh-13 | 33.8 | 2.311538462 | 3.373964497 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 117 | Exh-17 | 33.8 | 2.527810651 | 3.064497041 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 118 | Exh-19 | 33.8 | 2.239053254 | 3.44852071 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 119 | Exh-21 | 33.8 | 2.528106509 | 2.871301775 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 120 | Exh-23 | 33.8 | 2.455621302 | 3.431360947 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 121 | Exh-25 | 33.8 | 1.878106509 | 3.91183432 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 122 | Exh-27 | 33.8 | 2.166863905 | 3.850295858 | 220025 | 92.7 | 12.67559472 | 0.012675595 |
| 123 | | | | | | | | |
| 124 | #352 PENNZOIL 15W40 MOTORED 1500 RPM | | | | | | | |
| 125 | Stroke/rev | Cal (mV/µm) | Delta (µm) | h min (µm) | ΔP (Pa) | Oil Temp (°C) | µ (CP) | µ (Pa-s) |
| 126 | Exh-1 | 31.9 | 1.224451411 | 4.384326019 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 127 | Exh-3 | 31.9 | 2.831661442 | 5.179937304 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 128 | Exh-5 | 31.9 | 2.142946708 | 3.870532915 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 129 | Exh-7 | 31.9 | 2.678683386 | 4.282758621 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 130 | Exh-11 | 31.9 | 1.760188088 | 4.45015674 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 131 | Exh-13 | 31.9 | 1.68369906 | 4.415360502 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 132 | Exh-15 | 31.9 | 2.755172414 | 4.155485893 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 133 | Exh-17 | 31.9 | 2.142946708 | 4.573667712 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 134 | Exh-19 | 31.9 | 1.989655172 | 3.86677116 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 135 | Exh-21 | 31.9 | 2.295924765 | 3.305956113 | 220025 | 73 | 16.78137129 | 0.016781371 |
| 136 | | | | | | | | |
| 137 | #352 PENNZOIL 15W40 MOTORED 1500 RPM | | | | | | | |
| 138 | Stroke/rev | Cal (mV/µm) | Delta (µm) | h min (µm) | ΔP (Pa) | Oil Temp (°C) | µ (CP) | µ (Pa-s) |
| 139 | Exh-1 | 31.9 | 1.377429467 | 3.379623824 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 140 | Exh-3 | 31.9 | 2.142821317 | 2.768777429 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 141 | Exh-5 | 31.9 | 0.84169279 | 3.852351097 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 142 | Exh-9 | 31.9 | 0.994984326 | 3.564263323 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 143 | Exh-11 | 31.9 | 1.33354232 | 3.472727273 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 144 | Exh-13 | 31.9 | 0.765203762 | 3.947021944 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 145 | Exh-15 | 31.9 | 1.147962382 | 3.939498433 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 146 | Exh-17 | 31.9 | 1.224451411 | 4.242633229 | 220025 | 83.3 | 12.86091126 | 0.012860911 |

| | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|
| 147 | Exh-19 | 31.9 | 1.607210031 | 4.055485893 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 148 | Exh-21 | 31.9 | 2.06645768 | 3.659874608 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 149 | Exh-23 | 31.9 | 1.147962382 | 3.840125392 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 150 | Exh-25 | 31.9 | 1.530721003 | 4.446394984 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 151 | Exh-27 | 31.9 | 0.994984326 | 3.86677116 | 220025 | 83.3 | 12.86091126 | 0.012860911 |
| 152 | | | | | | | | |
| 153 | **#401 Pennzoil SAE30 Motored 1000 rpm** | | | | | | | |
| 154 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 155 | Exh-1 | 39.1 | 2.872378517 | 2.632225064 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 156 | Exh-3 | 39.1 | 2.765473146 | 2.653964194 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 157 | Exh-5 | 39.1 | 2.435294118 | 2.559335038 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 158 | Exh-7 | 39.1 | 2.123017903 | 2.762659847 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 159 | Exh-9 | 39.1 | 2.684910486 | 2.569309463 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 160 | Exh-11 | 39.1 | 2.747314578 | 2.681074169 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 161 | Exh-13 | 39.1 | 2.247826087 | 2.968542199 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 162 | Exh-15 | 39.1 | 2.49769821 | 3.19488491 | 220025 | 73 | 17.19084034 | 0.01719084 |
| 163 | | | | | | | | |
| 164 | **#402 Pennzoil SAE30 Motored 1500 rpm** | | | | | | | |
| 165 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 166 | Exh-2 | 39.1 | 3.184398977 | 2.895140665 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 167 | Exh-4 | 39.1 | 2.622506394 | 3.226342711 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 168 | Exh-6 | 39.1 | 3.683887468 | 2.839386189 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 169 | Exh-8 | 39.1 | 2.622506394 | 3.439130435 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 170 | Exh-10 | 39.1 | 2.684910486 | 3.110230179 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 171 | Exh-12 | 39.1 | 2.684910486 | 3.228388747 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 172 | Exh-14 | 39.1 | 2.872122762 | 3.169565217 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 173 | Exh-16 | 39.1 | 3.559079284 | 3.106393862 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 174 | Exh-18 | 39.1 | 2.560102302 | 3.001278772 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 175 | Exh-20 | 39.1 | 3.184398977 | 3.017391304 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 176 | Exh-22 | 39.1 | 2.997186701 | 3.411253197 | 220025 | 83.3 | 12.79394332 | 0.012793943 |
| 177 | | | | | | | | |
| 178 | **#403 Pennzoil SAE30 Motored 2000 rpm** | | | | | | | |
| 179 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 180 | Exh-2 | 39.1 | 2.435038363 | 3.269820972 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 181 | Exh-4 | 39.1 | 2.684910486 | 3.327877238 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 182 | Exh-6 | 39.1 | 2.247570332 | 3.146803069 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 183 | Exh-8 | 39.1 | 3.184398977 | 2.767007673 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 184 | Exh-10 | 39.1 | 1.935549872 | 3.505882353 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 185 | Exh-12 | 39.1 | 3.559079284 | 2.708439898 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 186 | Exh-14 | 39.1 | 2.622506394 | 3.706138107 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 187 | Exh-18 | 39.1 | 1.560869565 | 3.360613811 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 188 | Exh-22 | 39.1 | 3.059590793 | 3.270332481 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 189 | Exh-24 | 39.1 | 2.872122762 | 2.704092072 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 190 | Exh-26 | 39.1 | 2.747570332 | 3.307928389 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 191 | Exh-28 | 39.1 | 3.871355499 | 2.679283887 | 220025 | 92.7 | 10.07114496 | 0.010071145 |
| 192 | | | | | | | | |
| 193 | **#404 Pennzoil SAE30 Motored 2500 rpm** | | | | | | | |
| 194 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 195 | Exh-3 | 39.1 | 1.124040921 | 3.241176471 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 196 | Exh-5 | 39.1 | 1.186189258 | 3.575191816 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 197 | Exh-9 | 39.1 | 1.373657289 | 3.481074169 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 198 | Exh-17 | 39.1 | 0.561892583 | 4.34168798 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 199 | Exh-19 | 39.1 | 1.248849105 | 4.331713555 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 200 | Exh-21 | 39.1 | 1.813299233 | 3.030946292 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 201 | Exh-23 | 39.1 | 1.24859335 | 4.292327366 | 220025 | 101.3 | 8.2574414 | 0.009760465 |
| 202 | Exh-27 | 39.1 | 0.624296675 | 3.48797954 | 220025 | 101.3 | 8.2574414 | 0.009760465 |

| | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|
| 1 | #201 Cummins 15W40 Motored 1000 rpm | | | | | | | |
| 2 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 3 | Exh-2 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 559.8226922 | 79014.57928 | 0.00178628 |
| 4 | Exh-4 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 568.8520905 | 56062.91853 | 0.001757926 |
| 5 | Exh-6 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 549.6646192 | 71059.63808 | 0.001819291 |
| 6 | Exh-8 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 525.3981114 | 52513.59492 | 0.001903319 |
| 7 | Exh-10 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 527.6554609 | 45452.71769 | 0.001895176 |
| 8 | Exh-12 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 557.5653427 | 53307.42766 | 0.001793512 |
| 9 | Exh-14 | 863.838 | 3.81 | 0.00192 | 1083.527791 | 506.2106401 | 52063.84394 | 0.001975462 |
| 10 | | | | | | | | |
| 11 | #202 Cummins 15W40 Motored 1500 rpm | | | | | | | |
| 12 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 13 | Exh-2 | 857.349 | 5.715 | 0.00192 | 948.878777 | 342.4859336 | 50161.74365 | 0.002919828 |
| 14 | Exh-8 | 857.349 | 5.715 | 0.00192 | 948.878777 | 370.1615646 | 52083.21837 | 0.002701523 |
| 15 | Exh-10 | 857.349 | 5.715 | 0.00192 | 948.878777 | 342.4859336 | 50863.08779 | 0.002919828 |
| 16 | Exh-12 | 857.349 | 5.715 | 0.00192 | 948.878777 | 357.8063722 | 69209.35952 | 0.002794808 |
| 17 | Exh-14 | 857.349 | 5.715 | 0.00192 | 948.878777 | 370.1615646 | 71514.06642 | 0.002701523 |
| 18 | Exh-20 | 857.349 | 5.715 | 0.00192 | 948.878777 | 355.3353337 | 71092.36261 | 0.002814243 |
| 19 | Exh-22 | 857.349 | 5.715 | 0.00192 | 948.878777 | 398.3314033 | 53226.65819 | 0.002510472 |
| 20 | | | | | | | | |
| 21 | #203 Cummins 15W40 Motored 2000 rpm | | | | | | | |
| 22 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 23 | Exh-1 | 851.427 | 7.62 | 0.00192 | 887.634176 | 302.3503912 | 40819.65006 | 0.003307421 |
| 24 | Exh-3 | 851.427 | 7.62 | 0.00192 | 887.634176 | 355.0536704 | 58434.65077 | 0.002816476 |
| 25 | Exh-5 | 851.427 | 7.62 | 0.00192 | 887.634176 | 360.601384 | 71835.53558 | 0.002773145 |
| 26 | Exh-9 | 851.427 | 7.62 | 0.00192 | 887.634176 | 343.4959337 | 64917.06333 | 0.002911243 |
| 27 | Exh-13 | 851.427 | 7.62 | 0.00192 | 887.634176 | 326.3904835 | 40223.40202 | 0.003063815 |
| 28 | Exh-15 | 851.427 | 7.62 | 0.00192 | 887.634176 | 394.8122845 | 107942.8382 | 0.002532849 |
| 29 | Exh-19 | 851.427 | 7.62 | 0.00192 | 887.634176 | 342.5713148 | 49335.78443 | 0.0029191 |
| 30 | Exh-21 | 851.427 | 7.62 | 0.00192 | 887.634176 | 326.3904835 | 54424.4829 | 0.003063815 |
| 31 | Exh-23 | 851.427 | 7.62 | 0.00192 | 887.634176 | 463.6963951 | 44740.18876 | 0.002156584 |
| 32 | Exh-25 | 851.427 | 7.62 | 0.00192 | 887.634176 | 337.0236012 | 63977.12327 | 0.002967151 |
| 33 | Exh-27 | 851.427 | 7.62 | 0.00192 | 887.634176 | 343.4959337 | 42545.76033 | 0.002911243 |
| 34 | | | | | | | | |
| 35 | #204 Cummins 15W40 Motored 2500 rpm | | | | | | | |
| 36 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 37 | Exh-2 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 317.2097199 | 63568.47837 | 0.003152489 |
| 38 | Exh-4 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 366.5238361 | 103210.5434 | 0.002728336 |
| 39 | Exh-6 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 317.2097199 | 66239.12233 | 0.003152489 |
| 40 | Exh-10 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 357.1941384 | 70135.28413 | 0.002799598 |
| 41 | Exh-12 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 327.8722315 | 59439.92176 | 0.003049969 |
| 42 | Exh-14 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 310.9899215 | 55388.94012 | 0.003215538 |
| 43 | Exh-16 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 302.1044952 | 34833.58225 | 0.003310113 |
| 44 | Exh-22 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 367.85665 | 95429.37242 | 0.00271845 |
| 45 | Exh-24 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 301.6602239 | 45361.032 | 0.003314988 |
| 46 | Exh-28 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 300.1052742 | 58879.97065 | 0.003332164 |
| 47 | Exh-30 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 306.5472083 | 33699.17349 | 0.00326214 |
| 48 | Exh-34 | 846.009 | 9.525 | 0.00192 | 853.0009275 | 307.8800223 | 80513.87597 | 0.003248018 |
| 49 | | | | | | | | |
| 50 | | | | | | | | |
| 51 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 52 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 53 | Exh-1 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 591.9977784 | 313320.1754 | 0.001689196 |
| 54 | Exh-3 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 682.0354633 | 211872.1479 | 0.001466199 |
| 55 | Exh-5 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 619.0090839 | 138565.1086 | 0.001615485 |
| 56 | Exh-7 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 659.5260421 | 287183.7674 | 0.00151624 |
| 57 | Exh-9 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 692.1647029 | 315330.5401 | 0.001444743 |
| 58 | Exh-11 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 677.5335791 | 250208.9386 | 0.001475942 |
| 59 | Exh-13 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 671.9062238 | 329182.2088 | 0.001488303 |
| 60 | Exh-15 | 863.838 | 3.81 | 0.00192 | 1080.452219 | 656.1496289 | 319950.2837 | 0.001524043 |
| 61 | | | | | | | | |
| 62 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 63 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 64 | Exh-3 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 560.795825 | 294389.6758 | 0.00178318 |
| 65 | Exh-7 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 498.3943955 | 334612.5363 | 0.002006443 |
| 66 | Exh-9 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 499.4156955 | 299731.0687 | 0.00200234 |
| 67 | Exh-11 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 485.1174956 | 136934.1707 | 0.002061356 |
| 68 | Exh-13 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 506.5647954 | 237331.3768 | 0.001974081 |
| 69 | Exh-15 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 559.161745 | 204386.2873 | 0.001788391 |
| 70 | Exh-17 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 514.7351954 | 248354.2665 | 0.001942747 |
| 71 | Exh-19 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 465.2021458 | 205329.0715 | 0.002149603 |
| 72 | Exh-21 | 857.349 | 5.715 | 0.00192 | 980.4479912 | 647.5041942 | 465910.0245 | 0.001544392 |
| 73 | | | | | | | | |

| | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|
| 74 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 75 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 76 | Exh-1 | 851.427 | 7.62 | 0.00192 | 943.978284 | 590.9697382 | 294708.0452 | 0.001692134 |
| 77 | Exh-7 | 851.427 | 7.62 | 0.00192 | 943.978284 | 445.9314081 | 114194.2133 | 0.002242497 |
| 78 | Exh-9 | 851.427 | 7.62 | 0.00192 | 943.978284 | 404.6323582 | 88216.43682 | 0.002471379 |
| 79 | Exh-13 | 851.427 | 7.62 | 0.00192 | 943.978284 | 513.7798473 | 160974.7013 | 0.001946359 |
| 80 | Exh-17 | 851.427 | 7.62 | 0.00192 | 943.978284 | 408.0739457 | 87437.79045 | 0.002450536 |
| 81 | Exh-21 | 851.427 | 7.62 | 0.00192 | 943.978284 | 464.6143117 | 192888.3836 | 0.002152323 |
| 82 | Exh-25 | 851.427 | 7.62 | 0.00192 | 943.978284 | 387.4244207 | 43180.2243 | 0.002581149 |
| 83 | Exh-27 | 851.427 | 7.62 | 0.00192 | 943.978284 | 458.222792 | 159407.5433 | 0.002182345 |
| 84 | | | | | | | | |
| 85 | #301 MOBIL 1 MOTORED 1000 RPM | | | | | | | |
| 86 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 87 | Exh-1 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 407.7382588 | 132740.3033 | 0.002452554 |
| 88 | Exh-3 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 510.4754579 | 141126.4948 | 0.001958958 |
| 89 | Exh-5 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 519.1897739 | 160752.008 | 0.001926078 |
| 90 | Exh-7 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 527.9040899 | 136317.0213 | 0.001894283 |
| 91 | Exh-9 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 534.783813 | 140666.4001 | 0.001869914 |
| 92 | Exh-11 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 512.3100507 | 118512.4728 | 0.001951943 |
| 93 | Exh-13 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 520.5657185 | 148969.0498 | 0.001920987 |
| 94 | Exh-15 | 863.838 | 3.81 | 0.00192 | 880.6045635 | 501.3024937 | 117271.3295 | 0.001994804 |
| 95 | | | | | | | | |
| 96 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 97 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 98 | Exh-1 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 406.7982698 | 75575.47657 | 0.002458221 |
| 99 | Exh-3 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 463.7581069 | 110554.2556 | 0.002156297 |
| 100 | Exh-5 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 441.5397307 | 74588.30609 | 0.002264802 |
| 101 | Exh-7 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 464.5660479 | 107395.5952 | 0.002152546 |
| 102 | Exh-9 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 488.400306 | 143617.3113 | 0.002047501 |
| 103 | Exh-11 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 464.5660479 | 69154.65949 | 0.002152546 |
| 104 | Exh-13 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 476.6851622 | 117245.0973 | 0.002097821 |
| 105 | Exh-17 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 464.9700184 | 127132.0167 | 0.002150676 |
| 106 | Exh-19 | 857.349 | 5.715 | 0.00192 | 775.6233147 | 421.7451774 | 57482.65257 | 0.0023711 |
| 107 | | | | | | | | |
| 108 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 109 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 110 | Exh-1 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 421.8048042 | 123305.1338 | 0.002370765 |
| 111 | Exh-3 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 423.7031156 | 119189.8841 | 0.002360143 |
| 112 | Exh-5 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 438.5099449 | 71399.79044 | 0.00228045 |
| 113 | Exh-7 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 452.937112 | 139659.7945 | 0.002207812 |
| 114 | Exh-9 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 436.6116335 | 157185.9111 | 0.002290365 |
| 115 | Exh-11 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 452.937112 | 113065.7449 | 0.002207812 |
| 116 | Exh-13 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 424.4624402 | 109800.0633 | 0.002355921 |
| 117 | Exh-17 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 465.0863052 | 159791.5335 | 0.002150139 |
| 118 | Exh-19 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 422.5641288 | 104165.6796 | 0.002366505 |
| 119 | Exh-21 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 410.4149355 | 141740.4179 | 0.002436559 |
| 120 | Exh-23 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 435.8523089 | 111931.1505 | 0.002294355 |
| 121 | Exh-25 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 451.7981251 | 92540.75059 | 0.002213378 |
| 122 | Exh-27 | 851.427 | 7.62 | 0.00192 | 728.9515968 | 422.5641288 | 83560.71057 | 0.002366505 |
| 123 | | | | | | | | |
| 124 | #352 PENNZOIL 15W-40 MOTORED 1500 RPM | | | | | | | |
| 125 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 126 | Exh-1 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 381.5993617 | 51814.98788 | 0.00136214 |
| 127 | Exh-3 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 345.6571372 | 30457.05128 | 0.00136214 |
| 128 | Exh-5 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 383.128818 | 67018.37803 | 0.00136214 |
| 129 | Exh-7 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 393.8350125 | 57839.86272 | 0.00136214 |
| 130 | Exh-11 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 379.3051771 | 49690.42704 | 0.00136214 |
| 131 | Exh-13 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 361.3340649 | 45806.93995 | 0.00136214 |
| 132 | Exh-15 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 357.510424 | 50626.69736 | 0.00136214 |
| 133 | Exh-17 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 372.0402594 | 45258.11513 | 0.00136214 |
| 134 | Exh-19 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 335.3333068 | 51440.15224 | 0.00136214 |
| 135 | Exh-21 | 863.838 | 5.715 | 0.00192 | 734.1390525 | 397.6586534 | 98962.92219 | 0.00136214 |
| 136 | | | | | | | | |
| 137 | #353 PENNZOIL 15W40 MOTORED 2000 RPM | | | | | | | |
| 138 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 139 | Exh-1 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 308.7080929 | 59589.69618 | 0.001391889 |
| 140 | Exh-3 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 360.3465375 | 120969.6662 | 0.001391889 |
| 141 | Exh-5 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 337.1466566 | 54701.3267 | 0.001391889 |
| 142 | Exh-9 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 333.4047403 | 62490.76551 | 0.001391889 |
| 143 | Exh-11 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 254.0761152 | 38229.4626 | 0.001391889 |
| 144 | Exh-13 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 291.1210864 | 38852.60226 | 0.001391889 |
| 145 | Exh-15 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 309.4564762 | 44068.58998 | 0.001391889 |
| 146 | Exh-17 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 319.1854585 | 40422.86434 | 0.001391889 |

| | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|
| 147 | Exh-19 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 291.1210864 | 36802.16802 | 0.001391889 |
| 148 | Exh-21 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 277.2759962 | 40992.46208 | 0.001391889 |
| 149 | Exh-23 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 295.6113859 | 42321.72601 | 0.001391889 |
| 150 | Exh-25 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 318.4370752 | 36630.51639 | 0.001391889 |
| 151 | Exh-27 | 857.349 | 7.62 | 0.00192 | 718.4479253 | 304.9661766 | 44424.06296 | 0.001391889 |
| 152 | | | | | | | | |
| 153 | **#401 Pennzoil SAE30 Motored 1000 rpm** | | | | | | | |
| 154 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 155 | Exh-1 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 588.4389514 | 159426.0888 | 0.000930251 |
| 156 | Exh-3 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 649.4663973 | 191040.682 | 0.000930251 |
| 157 | Exh-5 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 652.2658214 | 207203.7285 | 0.000930251 |
| 158 | Exh-7 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 594.0377996 | 147494.5376 | 0.000930251 |
| 159 | Exh-9 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 685.2990261 | 226949.9037 | 0.000930251 |
| 160 | Exh-11 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 614.1936533 | 167415.4746 | 0.000930251 |
| 161 | Exh-13 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 555.9656315 | 111895.351 | 0.000930251 |
| 162 | Exh-15 | 863.838 | 3.81 | 0.00192 | 1074.978865 | 630.9901981 | 124433.5226 | 0.000930251 |
| 163 | | | | | | | | |
| 164 | **#402 Pennzoil SAE30 Motored 1500 rpm** | | | | | | | |
| 165 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 188 | Exh-2 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 604.3481112 | 173234.6468 | 0.001038481 |
| 167 | Exh-4 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 588.8005664 | 132408.2967 | 0.001038481 |
| 168 | Exh-6 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 561.2162128 | 155314.2278 | 0.001038481 |
| 169 | Exh-8 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 579.7729598 | 112984.3713 | 0.001038481 |
| 170 | Exh-10 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 546.1702017 | 122594.4183 | 0.001038481 |
| 171 | Exh-12 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 558.7085443 | 119069.0071 | 0.001038481 |
| 172 | Exh-14 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 547.6748028 | 118698.6808 | 0.001038481 |
| 173 | Exh-16 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 588.8005664 | 142831.2231 | 0.001038481 |
| 174 | Exh-18 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 575.7606902 | 146309.0206 | 0.001038481 |
| 175 | Exh-20 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 607.3573134 | 161073.8419 | 0.001038481 |
| 176 | Exh-22 | 857.349 | 5.715 | 0.00192 | 962.9447083 | 536.6410614 | 98387.43625 | 0.001038481 |
| 177 | | | | | | | | |
| 178 | **#403 Pennzoil SAE30 Motored 2000 rpm** | | | | | | | |
| 179 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 180 | Exh-2 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 478.8005961 | 93904.73537 | 0.001089963 |
| 181 | Exh-4 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 549.9994872 | 119623.3754 | 0.001089963 |
| 182 | Exh-6 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 584.4043204 | 151047.5843 | 0.001089963 |
| 183 | Exh-8 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 532.3192256 | 162087.5489 | 0.001089963 |
| 184 | Exh-10 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 567.6797487 | 114825.4628 | 0.001089963 |
| 185 | Exh-12 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 549.9994872 | 180597.7111 | 0.001089963 |
| 186 | Exh-14 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 549.0437974 | 96116.25905 | 0.001089963 |
| 187 | Exh-18 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 532.3192256 | 109883.6725 | 0.001089963 |
| 188 | Exh-22 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 496.4808577 | 100936.2765 | 0.001089963 |
| 189 | Exh-24 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 569.5911283 | 194316.4471 | 0.001089963 |
| 190 | Exh-26 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 582.9707857 | 136021.4697 | 0.001089963 |
| 191 | Exh-28 | 851.427 | 7.62 | 0.00192 | 917.4622201 | 532.3192256 | 172875.2881 | 0.001089963 |
| 192 | | | | | | | | |
| 193 | **#404 Pennzoil SAE30 Motored 2500 rpm** | | | | | | | |
| 194 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 195 | Exh-3 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 355.3939814 | 77275.92762 | 0.001320424 |
| 196 | Exh-5 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 377.0883976 | 71501.81887 | 0.001320424 |
| 197 | Exh-9 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 370.7772947 | 72917.06073 | 0.001320424 |
| 198 | Exh-17 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 427.9716646 | 62451.41143 | 0.001320424 |
| 199 | Exh-19 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 399.1772577 | 54581.00961 | 0.001320424 |
| 200 | Exh-21 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 478.4604877 | 160164.0788 | 0.001320424 |
| 201 | Exh-23 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 401.9383652 | 56358.92409 | 0.001320424 |
| 202 | Exh-27 | 846.009 | 9.525 | 0.00192 | 757.3323466 | 363.6773039 | 69873.73922 | 0.001320424 |

| | Y | Z | AA | AB | AC | AD | AE | AF |
|---|---|---|---|---|---|---|---|---|
| 1 | #201 Cummins 15W40 Motored 1000 rpm | | | | | | | |
| 2 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 3 | Exh-2 | 0.003913695 | 2.100121317 | 0.013713011 | 1.430219656 | 0.681017637 | 0.003236678 | 0.003359597 |
| 4 | Exh-4 | 0.001259041 | 1.298110768 | 0.019326996 | 1.06643585 | 0.821529161 | 0.004710085 | 0.004888959 |
| 5 | Exh-6 | 0.002222934 | 1.592567794 | 0.015248147 | 1.122911923 | 0.70509521 | 0.003469591 | 0.003601355 |
| 6 | Exh-8 | 0.002084832 | 1.477756869 | 0.020633282 | 1.158556174 | 0.783996473 | 0.004289543 | 0.004452446 |
| 7 | Exh-10 | 0.001756693 | 1.374520605 | 0.02383857 | 1.163277266 | 0.846314898 | 0.004998581 | 0.005188412 |
| 8 | Exh-12 | 0.001662457 | 1.383834775 | 0.020326019 | 1.142740513 | 0.825778145 | 0.004758933 | 0.004939662 |
| 9 | Exh-14 | 0.001747585 | 1.398755348 | 0.020811521 | 1.061124621 | 0.7586206 | 0.004016355 | 0.004168883 |
| 10 | | | | | | | | |
| 11 | #202 Cummins 15W40 Motored 1500 rpm | | | | | | | |
| 12 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 13 | Exh-2 | 0.001508312 | 1.337813797 | 0.018916383 | 1.562145324 | 1.167685165 | 0.002178953 | 0.002605131 |
| 14 | Exh-8 | 0.002321546 | 1.529817369 | 0.018218513 | 1.894747484 | 1.238544889 | 0.002451432 | 0.002930904 |
| 15 | Exh-10 | 0.001508312 | 1.340167197 | 0.018655548 | 1.554066854 | 1.159606695 | 0.002148908 | 0.00256921 |
| 16 | Exh-12 | 0.001546708 | 1.406902836 | 0.013710267 | 1.461164447 | 1.03856813 | 0.001723719 | 0.002060858 |
| 17 | Exh-14 | 0.001395663 | 1.373229825 | 0.013268422 | 1.451470283 | 1.056975501 | 0.001785362 | 0.002134558 |
| 18 | Exh-20 | 0.001142047 | 1.304505608 | 0.013347127 | 1.327523468 | 1.017644892 | 0.001654965 | 0.001978658 |
| 19 | Exh-22 | 0.001944893 | 1.448704482 | 0.017827134 | 1.90998117 | 1.318406338 | 0.002777762 | 0.00332106 |
| 20 | | | | | | | | |
| 21 | #203 Cummins 15W40 Motored 2000 rpm | | | | | | | |
| 22 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 23 | Exh-1 | 0.001598257 | 1.322909778 | 0.021745267 | 2.668963928 | 2.01749505 | 0.002230815 | 0.002849851 |
| 24 | Exh-3 | 0.00106954 | 1.258542689 | 0.015190202 | 2.49208765 | 1.98013756 | 0.002148965 | 0.002745288 |
| 25 | Exh-5 | 0.001627303 | 1.436152327 | 0.012356477 | 2.604922517 | 1.81382049 | 0.001803131 | 0.002303487 |
| 26 | Exh-9 | 0.002110298 | 1.537679062 | 0.013673357 | 2.794759557 | 1.81751812 | 0.00181049 | 0.002312889 |
| 27 | Exh-13 | 0.001057342 | 1.212058031 | 0.022067606 | 2.659243357 | 2.193990129 | 0.002638202 | 0.003370285 |
| 28 | Exh-15 | 0.001748276 | 1.574389986 | 0.008223187 | 2.550601677 | 1.620057102 | 0.001438465 | 0.001837629 |
| 29 | Exh-19 | 0.001712703 | 1.380419837 | 0.017991691 | 2.870236935 | 2.079249268 | 0.002369473 | 0.003026986 |
| 30 | Exh-21 | 0.001691963 | 1.394719025 | 0.016309465 | 2.630653441 | 1.886152977 | 0.001949811 | 0.00249087 |
| 31 | Exh-23 | 0.001777542 | 1.37598349 | 0.01983975 | 4.066629606 | 2.955434884 | 0.004787198 | 0.006115613 |
| 32 | Exh-25 | 0.002355621 | 1.595823695 | 0.013874243 | 2.866615545 | 1.796323462 | 0.001768511 | 0.002259261 |
| 33 | Exh-27 | 0.001004688 | 1.207233212 | 0.020863046 | 2.710324006 | 2.245070779 | 0.002762477 | 0.003529046 |
| 34 | | | | | | | | |
| 35 | #204 Cummins 15W40 Motored 2500 rpm | | | | | | | |
| 36 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 37 | Exh-2 | 0.00094086 | 1.237216937 | 0.013418615 | 3.258033967 | 2.633357069 | 0.001640769 | 0.00210169 |
| 38 | Exh-4 | 0.001176425 | 1.37794291 | 0.008264669 | 3.290452215 | 2.387945241 | 0.001349201 | 0.001728216 |
| 39 | Exh-6 | 0.001045623 | 1.269111633 | 0.0128776 | 3.27395872 | 2.579724774 | 0.001574616 | 0.002016954 |
| 40 | Exh-10 | 0.001299922 | 1.344259323 | 0.012162222 | 3.79492566 | 2.823060697 | 0.001885682 | 0.002415403 |
| 41 | Exh-12 | 0.001011743 | 1.246666128 | 0.01435064 | 3.509133207 | 2.814813949 | 0.001874681 | 0.002401312 |
| 42 | Exh-14 | 0.000629533 | 1.148159572 | 0.015400203 | 3.175566493 | 2.765788458 | 0.001809947 | 0.002318394 |
| 43 | Exh-16 | 0.000768573 | 1.143444687 | 0.02448789 | 3.873980687 | 3.387991331 | 0.002715892 | 0.003478835 |
| 44 | Exh-22 | 0.000721424 | 1.222859881 | 0.008938557 | 3.047884093 | 2.492423 | 0.001469845 | 0.00188275 |
| 45 | Exh-24 | 0.000549918 | 1.117122302 | 0.018804707 | 3.31178001 | 2.964563507 | 0.002079455 | 0.002663611 |
| 46 | Exh-28 | 0.000994574 | 1.241335369 | 0.014487115 | 3.213387782 | 2.588654011 | 0.001585536 | 0.002030941 |
| 47 | Exh-30 | 0.000757435 | 1.13904483 | 0.025312221 | 3.981188403 | 3.495199047 | 0.002890492 | 0.003702483 |
| 48 | Exh-34 | 0.001723968 | 1.489175213 | 0.010594459 | 3.382019548 | 2.271068924 | 0.001220362 | 0.001563183 |
| 49 | | | | | | | | |
| 50 | | | | | | | | |
| 51 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 52 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 53 | Exh-1 | 0.002868346 | 2.605556967 | 0.003448397 | 0.942297298 | 0.361649087 | 0.00091536 | 0.000950123 |
| 54 | Exh-3 | 0.003734472 | 2.71896136 | 0.005099548 | 1.377636164 | 0.50667736 | 0.00179672 | 0.001864953 |
| 55 | Exh-5 | 0.002805414 | 2.044296578 | 0.007797433 | 1.162453146 | 0.56863234 | 0.002262978 | 0.002348919 |
| 56 | Exh-7 | 0.003393867 | 2.818757466 | 0.003762233 | 1.186236248 | 0.420836579 | 0.001239494 | 0.001286566 |
| 57 | Exh-9 | 0.002397506 | 2.346302803 | 0.003426412 | 0.988944609 | 0.421490614 | 0.001243349 | 0.001290568 |
| 58 | Exh-11 | 0.003873115 | 2.937366523 | 0.0043182 | 1.36050152 | 0.4631705 | 0.001501409 | 0.001558428 |
| 59 | Exh-13 | 0.003503567 | 3.010150366 | 0.003282232 | 1.205424887 | 0.40045338 | 0.001122332 | 0.001164954 |
| 60 | Exh-15 | 0.003823092 | 3.162499148 | 0.003376938 | 1.254450508 | 0.396664299 | 0.001101193 | 0.001143013 |
| 61 | | | | | | | | |
| 62 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 63 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 64 | Exh-3 | 0.002310574 | 2.253663817 | 0.003330443 | 1.778696916 | 0.789246782 | 0.000963403 | 0.001151834 |
| 65 | Exh-7 | 0.002810543 | 2.625778311 | 0.002930099 | 1.727545277 | 0.657917414 | 0.000669461 | 0.0008004 |
| 66 | Exh-9 | 0.0025245 | 2.382105511 | 0.003271092 | 1.659306581 | 0.696571404 | 0.000750436 | 0.000897213 |
| 67 | Exh-11 | 0.002310053 | 1.854826356 | 0.007159995 | 1.856793529 | 1.00106057 | 0.001549899 | 0.001853041 |
| 68 | Exh-13 | 0.002765353 | 2.347187927 | 0.004131135 | 1.863694071 | 0.794011442 | 0.000975071 | 0.001165783 |
| 69 | Exh-15 | 0.001787594 | 1.808155313 | 0.004797034 | 1.70771991 | 0.944454217 | 0.001379572 | 0.0016494 |
| 70 | Exh-17 | 0.003401802 | 2.695293513 | 0.00394778 | 2.125805144 | 0.788710073 | 0.000962094 | 0.001150268 |
| 71 | Exh-19 | 0.002785185 | 2.262057788 | 0.004775008 | 1.773329827 | 0.783945413 | 0.000950505 | 0.001136412 |
| 72 | Exh-21 | 0.00221744 | 2.513571137 | 0.002104372 | 1.820757364 | 0.724370732 | 0.00081153 | 0.000970255 |
| 73 | | | | | | | | |

| | Y | Z | AA | AB | AC | AD | AE | AF |
|---|---|---|---|---|---|---|---|---|
| 74 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 75 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 76 | Exh-1 | 0.001369347 | 1.743377651 | 0.003203096 | 2.558569996 | 1.467593664 | 0.001109998 | 0.001418015 |
| 77 | Exh-7 | 0.001134094 | 1.383240364 | 0.008266428 | 2.46082227 | 1.779027228 | 0.001631082 | 0.002083696 |
| 78 | Exh-9 | 0.001666451 | 1.494956663 | 0.010700707 | 2.745687071 | 1.836633221 | 0.001738423 | 0.002220824 |
| 79 | Exh-13 | 0.001640691 | 1.658272489 | 0.005864141 | 2.862798156 | 1.726373787 | 0.001535961 | 0.00196218 |
| 80 | Exh-17 | 0.000991404 | 1.293156936 | 0.010795999 | 2.405897358 | 1.860483666 | 0.001783867 | 0.002278877 |
| 81 | Exh-21 | 0.001451459 | 1.637467363 | 0.004893909 | 2.335332809 | 1.426185866 | 0.001048245 | 0.001339126 |
| 82 | Exh-25 | 0.000870145 | 1.180814815 | 0.021861357 | 2.967993328 | 2.513512949 | 0.003255914 | 0.004159408 |
| 83 | Exh-27 | 0.000956563 | 1.381916199 | 0.005921792 | 2.138161682 | 1.547244097 | 0.001233753 | 0.001576111 |
| 84 | | | | | | | | |
| 85 | #301 MOBIL 1 MOTORED 1000 RPM | | | | | | | |
| 86 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 87 | Exh-1 | 0.00552499 | 3.012949536 | 0.006634041 | 1.153010854 | 0.382685087 | 0.001257549 | 0.001305307 |
| 88 | Exh-3 | 0.004023722 | 2.511583783 | 0.006239825 | 1.167023864 | 0.464656553 | 0.001853984 | 0.001924393 |
| 89 | Exh-5 | 0.004083729 | 2.637325789 | 0.005478031 | 1.167812675 | 0.442801826 | 0.001683685 | 0.001747626 |
| 90 | Exh-7 | 0.004141755 | 2.529182879 | 0.006459975 | 1.236578504 | 0.488924116 | 0.002052697 | 0.002130652 |
| 91 | Exh-9 | 0.002911385 | 2.091929958 | 0.006260234 | 1.019980063 | 0.487578496 | 0.002041414 | 0.00211894 |
| 92 | Exh-11 | 0.003879792 | 2.335643294 | 0.00743048 | 1.188553786 | 0.508876415 | 0.002223651 | 0.002308098 |
| 93 | Exh-13 | 0.003818393 | 2.473766286 | 0.005911326 | 1.140900273 | 0.461199701 | 0.001826501 | 0.001895866 |
| 94 | Exh-15 | 0.002114586 | 1.724137931 | 0.007509121 | 0.863052915 | 0.500570691 | 0.002151656 | 0.002233369 |
| 95 | | | | | | | | |
| 96 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 97 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 98 | Exh-1 | 0.00286897 | 1.788708505 | 0.010262897 | 2.021145401 | 1.129946772 | 0.002496159 | 0.002984379 |
| 99 | Exh-3 | 0.002575872 | 1.85646958 | 0.007015771 | 1.977247137 | 1.065057655 | 0.002217699 | 0.002651455 |
| 100 | Exh-5 | 0.003039785 | 1.830191469 | 0.010398725 | 2.25943722 | 1.234535981 | 0.00297964 | 0.003562423 |
| 101 | Exh-7 | 0.002449704 | 1.802799089 | 0.007222115 | 1.951510526 | 1.08248919 | 0.002290886 | 0.002738956 |
| 102 | Exh-9 | 0.002927501 | 2.109431513 | 0.005400626 | 2.075904149 | 0.984105972 | 0.00189339 | 0.002263715 |
| 103 | Exh-11 | 0.001947003 | 1.51200866 | 0.011215778 | 2.03967211 | 1.348981765 | 0.003557693 | 0.004253536 |
| 104 | Exh-13 | 0.003244409 | 2.11092033 | 0.006615401 | 2.244013506 | 1.063049834 | 0.002209345 | 0.002641467 |
| 105 | Exh-17 | 0.002635732 | 1.939785538 | 0.006100928 | 1.931614847 | 0.995787838 | 0.001938608 | 0.002317777 |
| 106 | Exh-19 | 0.002698429 | 1.646962903 | 0.013493172 | 2.212253432 | 1.343232096 | 0.00352743 | 0.004217355 |
| 107 | | | | | | | | |
| 108 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 109 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 110 | Exh-1 | 0.002665385 | 1.93594539 | 0.00591177 | 3.135094429 | 1.619412637 | 0.001750205 | 0.002235875 |
| 111 | Exh-3 | 0.002459386 | 1.849075599 | 0.006115885 | 3.059378484 | 1.654544836 | 0.001826968 | 0.00233394 |
| 112 | Exh-5 | 0.002001076 | 1.534702259 | 0.010209436 | 3.395405849 | 2.21241992 | 0.003266699 | 0.004173185 |
| 113 | Exh-7 | 0.001937585 | 1.724096386 | 0.005219481 | 2.817087459 | 1.633950099 | 0.00178177 | 0.002276199 |
| 114 | Exh-9 | 0.003454567 | 2.369620873 | 0.004637512 | 3.51806568 | 1.484653398 | 0.001471039 | 0.001879242 |
| 115 | Exh-11 | 0.002058358 | 1.692128085 | 0.006447148 | 3.072855922 | 1.815971231 | 0.002200857 | 0.00281158 |
| 116 | Exh-13 | 0.002067566 | 1.685110488 | 0.0066389 | 2.91006664 | 1.726929279 | 0.001990321 | 0.002542621 |
| 117 | Exh-17 | 0.002063519 | 1.824869666 | 0.004561891 | 2.862365595 | 1.568531522 | 0.001641952 | 0.002097583 |
| 118 | Exh-19 | 0.002011728 | 1.649279341 | 0.006998002 | 2.911126663 | 1.765090116 | 0.002079255 | 0.002656234 |
| 119 | Exh-21 | 0.002338674 | 1.880473982 | 0.005142863 | 2.763632002 | 1.469646497 | 0.00144145 | 0.001841443 |
| 120 | Exh-23 | 0.002139043 | 1.715640628 | 0.0065125 | 3.013191757 | 1.756307066 | 0.002058614 | 0.002629865 |
| 121 | Exh-25 | 0.001578241 | 1.480108909 | 0.007877088 | 2.963522097 | 2.002232456 | 0.002675488 | 0.003417917 |
| 122 | Exh-27 | 0.001946868 | 1.562778546 | 0.008723617 | 3.079821789 | 1.970734623 | 0.002591972 | 0.003311226 |
| 123 | | | | | | | | |
| 124 | #352 PENNZOIL 15W-40 MOTORED 1500 RPM | | | | | | | |
| 125 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 126 | Exh-1 | 0.001226905 | 1.279279279 | 0.014168469 | 1.650020346 | 1.289804637 | 0.003384756 | 0.004046775 |
| 127 | Exh-3 | 0.003132369 | 1.546659405 | 0.024104075 | 2.35689526 | 1.523861849 | 0.004724661 | 0.005648751 |
| 128 | Exh-5 | 0.002138669 | 1.553656759 | 0.010954295 | 1.769077817 | 1.138654215 | 0.00263793 | 0.003153878 |
| 129 | Exh-7 | 0.002600663 | 1.625457473 | 0.012692614 | 2.047954495 | 1.259924993 | 0.00322975 | 0.003861452 |
| 130 | Exh-11 | 0.001774383 | 1.395533953 | 0.014774255 | 1.826992683 | 1.309171073 | 0.003487163 | 0.004169212 |
| 131 | Exh-13 | 0.001781692 | 1.381327654 | 0.016026808 | 1.794254184 | 1.298934528 | 0.003432844 | 0.004104268 |
| 132 | Exh-15 | 0.002946708 | 1.663020519 | 0.014501026 | 2.033014673 | 1.222483217 | 0.003040642 | 0.003635357 |
| 133 | Exh-17 | 0.002202412 | 1.468540096 | 0.016221158 | 1.975929798 | 1.345506196 | 0.003683417 | 0.004403851 |
| 134 | Exh-19 | 0.002268706 | 1.514552088 | 0.014271712 | 1.722875034 | 1.137547562 | 0.002632805 | 0.003147751 |
| 135 | Exh-21 | 0.00220762 | 1.69448132 | 0.007418324 | 1.647991482 | 0.972563971 | 0.001924491 | 0.002300899 |
| 136 | | | | | | | | |
| 137 | #353 PENNZOIL 15W40 MOTORED 2000 RPM | | | | | | | |
| 138 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 139 | Exh-1 | 0.001669611 | 1.407568871 | 0.01205658 | 2.416456002 | 1.716758626 | 0.001968228 | 0.002514398 |
| 140 | Exh-3 | 0.002225152 | 1.773923282 | 0.005939075 | 2.494960964 | 1.406464975 | 0.001321036 | 0.001687615 |
| 141 | Exh-5 | 0.000934176 | 1.218488079 | 0.013134013 | 2.384448907 | 1.956891453 | 0.002557351 | 0.003266999 |
| 142 | Exh-9 | 0.001116705 | 1.279155673 | 0.011496865 | 2.315976019 | 1.810550559 | 0.002189164 | 0.002796642 |
| 143 | Exh-11 | 0.00196398 | 1.384004333 | 0.018793043 | 2.441456568 | 1.764052691 | 0.002078165 | 0.002654842 |
| 144 | Exh-13 | 0.000983552 | 1.193868636 | 0.018491629 | 2.393684785 | 2.004981714 | 0.002684589 | 0.003429544 |
| 145 | Exh-15 | 0.001388104 | 1.291398106 | 0.016302948 | 2.584294198 | 2.001159972 | 0.002674364 | 0.003416482 |
| 146 | Exh-17 | 0.001435465 | 1.288606473 | 0.017773306 | 2.77713296 | 2.155144351 | 0.00310177 | 0.00396249 |

| | Y | Z | AA | AB | AC | AD | AE | AF |
|---|---|---|---|---|---|---|---|---|
| 147 | Exh-19 | 0.002065823 | 1.396305171 | 0.019521891 | 2.876498268 | 2.060078504 | 0.00283416 | 0.003620621 |
| 148 | Exh-21 | 0.002788742 | 1.564625268 | 0.017526342 | 2.908823841 | 1.859118538 | 0.002308187 | 0.002948694 |
| 149 | Exh-23 | 0.001453117 | 1.298938776 | 0.016975865 | 2.533815348 | 1.950681122 | 0.002541145 | 0.003246296 |
| 150 | Exh-25 | 0.001798732 | 1.344261139 | 0.019613371 | 3.036215261 | 2.25864988 | 0.003406863 | 0.004352245 |
| 151 | Exh-27 | 0.00122084 | 1.257316579 | 0.016172495 | 2.46964192 | 1.96421646 | 0.002576532 | 0.003291503 |
| 152 | | | | | | | | |
| 153 | #401 Pennzoil SAE30 Motored 1000 rpm | | | | | | | |
| 154 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 155 | Exh-1 | 0.002732996 | 2.091235911 | 0.006742804 | 1.05386801 | 0.503945062 | 0.001786444 | 0.001854287 |
| 156 | Exh-3 | 0.002384029 | 2.042015997 | 0.005626963 | 1.037562753 | 0.508107064 | 0.001816073 | 0.001885042 |
| 157 | Exh-5 | 0.002090381 | 1.951533926 | 0.005188029 | 0.956232327 | 0.489990112 | 0.001688875 | 0.001753013 |
| 158 | Exh-7 | 0.002000959 | 1.768468802 | 0.007288262 | 0.935373349 | 0.528917077 | 0.001967878 | 0.002042611 |
| 159 | Exh-9 | 0.002193554 | 2.044993032 | 0.004736635 | 1.005931534 | 0.491899737 | 0.001702065 | 0.001766704 |
| 160 | Exh-11 | 0.002504389 | 2.024706668 | 0.006421025 | 1.039276519 | 0.513297326 | 0.001853365 | 0.00192375 |
| 161 | Exh-13 | 0.002263672 | 1.757215473 | 0.009607002 | 0.998684753 | 0.568333689 | 0.002272112 | 0.0023584 |
| 162 | Exh-15 | 0.002216236 | 1.781780339 | 0.008638981 | 1.089857091 | 0.61166748 | 0.002631805 | 0.002731753 |
| 163 | | | | | | | | |
| 164 | #402 Pennzoil SAE30 Motored 1500 rpm | | | | | | | |
| 165 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 166 | Exh-2 | 0.002642655 | 2.099911661 | 0.005558615 | 2.328306511 | 1.108764028 | 0.001935905 | 0.002314546 |
| 167 | Exh-4 | 0.002233821 | 1.812841855 | 0.007272541 | 2.239957999 | 1.235605849 | 0.002404173 | 0.002874401 |
| 168 | Exh-6 | 0.003292125 | 2.297423888 | 0.006199977 | 2.498245167 | 1.087411505 | 0.00186206 | 0.002226257 |
| 169 | Exh-8 | 0.002268604 | 1.762549267 | 0.008522813 | 2.321450196 | 1.317098046 | 0.002731757 | 0.003266057 |
| 170 | Exh-10 | 0.002465483 | 1.863251377 | 0.007854719 | 2.219389055 | 1.191137751 | 0.00223424 | 0.002671231 |
| 171 | Exh-12 | 0.002410153 | 1.8316565 | 0.008087283 | 2.264640732 | 1.236389428 | 0.002407223 | 0.002878048 |
| 172 | Exh-14 | 0.002630149 | 1.906156701 | 0.008112514 | 2.313810303 | 1.213861537 | 0.0023203 | 0.002774124 |
| 173 | Exh-16 | 0.003031584 | 2.145726988 | 0.006741836 | 2.552703895 | 1.189668541 | 0.002228731 | 0.002664646 |
| 174 | Exh-18 | 0.002230054 | 1.853003835 | 0.006581581 | 2.129865175 | 1.149412179 | 0.00208045 | 0.002487363 |
| 175 | Exh-20 | 0.002629562 | 2.055348364 | 0.005978281 | 2.375125345 | 1.155582862 | 0.002102848 | 0.002514141 |
| 176 | Exh-22 | 0.002801109 | 1.878617484 | 0.009787273 | 2.454266806 | 1.306421785 | 0.002687649 | 0.003213323 |
| 177 | | | | | | | | |
| 178 | #403 Pennzoil SAE30 Motored 2000 rpm | | | | | | | |
| 179 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 180 | Exh-2 | 0.002430178 | 1.744700821 | 0.009770138 | 3.675094264 | 2.106432358 | 0.00235277 | 0.003005648 |
| 181 | Exh-4 | 0.002332676 | 1.806793729 | 0.00766959 | 3.873463021 | 2.143832447 | 0.00243706 | 0.003113327 |
| 182 | Exh-6 | 0.001837752 | 1.714239272 | 0.006073995 | 3.475077926 | 2.02718371 | 0.002179067 | 0.002783744 |
| 183 | Exh-8 | 0.002858527 | 2.150845734 | 0.005660288 | 3.833921076 | 1.782517925 | 0.001684815 | 0.00215234 |
| 184 | Exh-10 | 0.001629251 | 1.552086373 | 0.007990059 | 3.505393417 | 2.258504087 | 0.002704744 | 0.003455293 |
| 185 | Exh-12 | 0.003092163 | 2.314069877 | 0.005080143 | 4.037562093 | 1.74478832 | 0.001614247 | 0.002062189 |
| 186 | Exh-14 | 0.002282425 | 1.707611621 | 0.009545338 | 4.076939279 | 2.387509683 | 0.003022559 | 0.003861298 |
| 187 | Exh-18 | 0.00140114 | 1.464459665 | 0.008349395 | 3.170440192 | 2.164921484 | 0.002485242 | 0.00317488 |
| 188 | Exh-22 | 0.002944746 | 1.935559553 | 0.009089519 | 4.07776307 | 2.106761874 | 0.002353506 | 0.003006588 |
| 189 | Exh-24 | 0.002409499 | 2.062139412 | 0.004721485 | 3.592220938 | 1.741987432 | 0.001609068 | 0.002055574 |
| 190 | Exh-26 | 0.002252107 | 1.830601515 | 0.006744981 | 3.900977624 | 2.130981315 | 0.002407929 | 0.003076113 |
| 191 | Exh-28 | 0.003475184 | 2.444921726 | 0.005307076 | 4.219949313 | 1.726005896 | 0.00157968 | 0.00201803 |
| 192 | | | | | | | | |
| 193 | #404 Pennzoil SAE30 Motored 2500 rpm | | | | | | | |
| 194 | Stroke/rev | ∂/b | (∂+ho)/ho | ΔPBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 195 | Exh-3 | 0.001247548 | 1.346800284 | 0.009800366 | 3.603921537 | 2.675913853 | 0.00190825 | 0.002444311 |
| 196 | Exh-5 | 0.001240784 | 1.331783389 | 0.010591791 | 3.930994097 | 2.951676773 | 0.00232182 | 0.002974061 |
| 197 | Exh-9 | 0.001461338 | 1.394607303 | 0.010386216 | 4.008064133 | 2.873973286 | 0.002201184 | 0.002819536 |
| 198 | Exh-17 | 0.000517873 | 1.129418002 | 0.012126745 | 4.048393932 | 3.584495665 | 0.003424105 | 0.004385997 |
| 199 | Exh-19 | 0.001234041 | 1.288303714 | 0.013875382 | 4.60731005 | 3.576260785 | 0.00340839 | 0.004365868 |
| 200 | Exh-21 | 0.001494888 | 1.59826175 | 0.004728478 | 3.999406951 | 2.50234791 | 0.001668731 | 0.002137507 |
| 201 | Exh-23 | 0.001225312 | 1.290889591 | 0.013437665 | 4.574581679 | 3.543743564 | 0.00334669 | 0.004286835 |
| 202 | Exh-27 | 0.000677111 | 1.178985188 | 0.010838583 | 3.395093414 | 2.879674357 | 0.002209926 | 0.002830734 |

| | AG | AH | AI | AJ | AK | AL |
|---|---|---|---|---|---|---|
| 1 | #201 Cummins 15W40 Motored 1000 rpm | | | | | |
| 2 | Stroke/rev | Delta2(Volts) | Delta2(µm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 3 | Exh-2 | 0.08544 | 2.612844037 | 1.740381282 | 18412.97217 | 1079610.052 |
| 4 | Exh-4 | 0.06591 | 2.01559633 | 1.473457367 | 15263.68069 | 894957.2588 |
| 5 | Exh-6 | 0.0708 | 2.165137615 | 1.592567794 | 17784.20647 | 1042743.555 |
| 6 | Exh-8 | 0.08545 | 2.613149847 | 1.643206624 | 15994.40714 | 937802.0324 |
| 7 | Exh-10 | 0.06348 | 1.941284404 | 1.442646956 | 14816.65845 | 868746.9493 |
| 8 | Exh-12 | 0.05859 | 1.791743119 | 1.418709355 | 15185.14249 | 890352.319 |
| 9 | Exh-14 | 0.083 | 2.5382263 | 1.645663166 | 16529.42037 | 969171.5286 |
| 10 | | | | | | |
| 11 | #202 Cummins 15W40 Motored 1500 rpm | | | | | |
| 12 | Stroke/rev | Delta2(Volts) | Delta2(µm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 13 | Exh-2 | 0.01465 | 0.448012232 | 1.144791461 | 23980.83784 | 1847010.279 |
| 14 | Exh-8 | 0.00977 | 0.298776758 | 1.091036154 | 22608.84432 | 1741338.986 |
| 15 | Exh-10 | 0.05127 | 1.567889908 | 1.510250796 | 24147.9018 | 1859877.588 |
| 16 | Exh-12 | 0.046388 | 1.418593272 | 1.515468042 | 26962.18745 | 2076634.59 |
| 17 | Exh-14 | 0.031743 | 0.970733945 | 1.34658849 | 26492.63731 | 2040469.717 |
| 18 | Exh-20 | 0.031741 | 0.970672783 | 1.359960988 | 27516.54218 | 2119331.133 |
| 19 | Exh-22 | 0.03906 | 1.194495413 | 1.341911765 | 21239.331 | 1635858.718 |
| 20 | | | | | | |
| 21 | #203 Cummins 15W40 Motored 2000 rpm | | | | | |
| 22 | Stroke/rev | Delta2(Volts) | Delta2(µm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 23 | Exh-1 | 0.04638 | 1.418348624 | 1.438167218 | 24504.4457 | 2354029.287 |
| 24 | Exh-3 | 0.06836 | 2.090519878 | 1.658003658 | 24966.74923 | 2398440.658 |
| 25 | Exh-5 | 0.080566 | 2.463792049 | 1.846601656 | 27256.05878 | 2618364.087 |
| 26 | Exh-9 | 0.078122 | 2.389051988 | 1.819249565 | 27200.608 | 2613037.186 |
| 27 | Exh-13 | 0.03173 | 0.970336391 | 1.275649379 | 22533.19066 | 2164659.891 |
| 28 | Exh-15 | 0.068352 | 2.090275229 | 1.804160098 | 30515.96011 | 2931527.801 |
| 29 | Exh-19 | 0.03418 | 1.045259939 | 1.313319278 | 23776.6576 | 2284114.034 |
| 30 | Exh-21 | 0.019531 | 0.597278287 | 1.197364565 | 26210.81031 | 2517951.879 |
| 31 | Exh-23 | 0.03418 | 1.045259939 | 1.220430801 | 16727.68978 | 1606952.148 |
| 32 | Exh-25 | 0.039064 | 1.194617737 | 1.41448974 | 27521.5455 | 2643868.175 |
| 33 | Exh-27 | 0.0293 | 0.896024465 | 1.248747771 | 22020.50749 | 2115408.778 |
| 34 | | | | | | |
| 35 | #204 Cummins 15W40 Motored 2500 rpm | | | | | |
| 36 | Stroke/rev | Delta2(Volts) | Delta2(µm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 37 | Exh-2 | 0.063477 | 1.941192661 | 1.685474553 | 29147.08992 | 3363470.946 |
| 38 | Exh-4 | 0.065917 | 2.015810398 | 1.784978505 | 32142.56925 | 3709138.652 |
| 39 | Exh-6 | 0.053713 | 1.642599388 | 1.592094095 | 29753.05585 | 3433397.268 |
| 40 | Exh-10 | 0.075686 | 2.314556575 | 1.762394988 | 27188.46795 | 3137452.908 |
| 41 | Exh-12 | 0.014646 | 0.447889908 | 1.147963307 | 27268.12381 | 3146644.912 |
| 42 | Exh-14 | 0.0193 | 0.590214067 | 1.198437179 | 27751.46995 | 3202421.345 |
| 43 | Exh-16 | 0.00031 | 0.009480122 | 1.002601981 | 22654.92671 | 2614298.305 |
| 44 | Exh-22 | 0.073243 | 2.239847095 | 1.83565895 | 30795.21225 | 3553658.425 |
| 45 | Exh-24 | 0.04395 | 1.344036697 | 1.421582734 | 25890.72391 | 2987697.842 |
| 46 | Exh-28 | 0.056149 | 1.717094801 | 1.616811855 | 29650.42642 | 3421554.196 |
| 47 | Exh-30 | 0.03418 | 1.045259939 | 1.278089659 | 21960.03554 | 2534110.325 |
| 48 | Exh-34 | 0.024417 | 0.746697248 | 1.305736073 | 33796.72649 | 3900022.539 |
| 49 | | | | | | |
| 50 | | | | | | |
| 51 | #251 Havoline SAE30 Motored 1000 rpm | | | | | |
| 52 | Stroke/rev | Delta2(Volts) | Delta2(µm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 53 | Exh-1 | 0.004883 | 0.137162921 | 1.0729819 | 34673.2765 | 2027231.829 |
| 54 | Exh-3 | 0.019532 | 0.548651685 | 1.208368004 | 24748.60687 | 1446969.212 |
| 55 | Exh-5 | 0.06347 | 1.782865169 | 1.603326996 | 22052.13793 | 1289315.589 |
| 56 | Exh-7 | 0.031743 | 0.891657303 | 1.407709005 | 29796.7416 | 1742116.958 |
| 57 | Exh-9 | 0.034182 | 0.960168539 | 1.438354408 | 29750.50541 | 1739413.681 |
| 58 | Exh-11 | 0.048831 | 1.371657303 | 1.56986311 | 27073.31059 | 1582886.952 |
| 59 | Exh-13 | 0.021973 | 0.617219101 | 1.296587749 | 31313.40484 | 1830791.243 |
| 60 | Exh-15 | 0.019531 | 0.548623596 | 1.266144307 | 31612.52178 | 1848279.621 |
| 61 | | | | | | |
| 62 | #252 Havoline SAE30 Motored 1500 rpm | | | | | |
| 63 | Stroke/rev | Delta2(Volts) | Delta2(µm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 64 | Exh-3 | 0.019531 | 0.548623596 | 1.27105307 | 35479.48402 | 2823553.903 |
| 65 | Exh-7 | 0.024414 | 0.685786517 | 1.406452902 | 42561.67716 | 3387174.108 |
| 66 | Exh-9 | 0.031739 | 0.891544944 | 1.499080116 | 40199.85377 | 3199213.775 |
| 67 | Exh-11 | 0.014646 | 0.411404494 | 1.16025122 | 27972.40191 | 2226119.877 |
| 68 | Exh-13 | 0.041499 | 1.165702247 | 1.572471065 | 35266.58068 | 2806610.476 |
| 69 | Exh-15 | 0.023294 | 0.654325843 | 1.270150535 | 29648.94232 | 2359543.525 |
| 70 | Exh-17 | 0.012207 | 0.342893258 | 1.169525185 | 35503.62743 | 2825475.301 |
| 71 | Exh-19 | 0.021973 | 0.617219101 | 1.307005533 | 35719.41123 | 2842647.963 |
| 72 | Exh-21 | 0.004883 | 0.137162921 | 1.073836058 | 38657.09555 | 3076436.877 |
| 73 | | | | | | |

| | AG | AH | AI | AJ | AK | AL |
|---|---|---|---|---|---|---|
| 74 | #253 Havoline SAE30 Motored 2000 rpm | | | | | |
| 75 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 76 | Exh-1 | 0.009766 | 0.274325843 | 1.123896275 | 33686.16198 | 3441489.902 |
| 77 | Exh-7 | 0.014649 | 0.411488764 | 1.153310797 | 27789.11819 | 2839028.372 |
| 78 | Exh-9 | 0.007325 | 0.205758427 | 1.074256171 | 26917.51261 | 2749982.26 |
| 79 | Exh-13 | 0.019527 | 0.548511236 | 1.210594998 | 28636.67086 | 2925617.161 |
| 80 | Exh-17 | 0.014644 | 0.411348315 | 1.146548446 | 26572.44393 | 2714728.899 |
| 81 | Exh-21 | 0.004883 | 0.137162921 | 1.063746736 | 34664.20407 | 3541409.922 |
| 82 | Exh-25 | 0.01709 | 0.48005618 | 1.126592593 | 19668.72616 | 2009422.222 |
| 83 | Exh-27 | 0.004883 | 0.137162921 | 1.058759115 | 31952.03523 | 3264325.768 |
| 84 | | | | | | |
| 85 | #301 MOBIL 1 MOTORED 1000 RPM | | | | | |
| 86 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 87 | Exh-1 | 0.029296 | 0.866745562 | 1.355214977 | 32767.30459 | 1561437.544 |
| 88 | Exh-3 | 0.04168 | 1.233136095 | 1.416217296 | 26986.72537 | 1285979.629 |
| 89 | Exh-5 | 0.04639 | 1.372485207 | 1.486115477 | 28318.67 | 1349449.859 |
| 90 | Exh-7 | 0.02929 | 0.866568047 | 1.277972858 | 25647.24949 | 1222150.517 |
| 91 | Exh-9 | 0.04638 | 1.372189349 | 1.441377998 | 25718.03082 | 1225523.411 |
| 92 | Exh-11 | 0.03174 | 0.939053254 | 1.289413696 | 24641.65842 | 1174231.786 |
| 93 | Exh-13 | 0.119625 | 3.539201183 | 2.203531365 | 27189.00024 | 1295618.492 |
| 94 | Exh-15 | 0.08301 | 2.45591716 | 1.769466073 | 25050.52538 | 1193715.239 |
| 95 | | | | | | |
| 96 | #302 Mobil 1 Motored 1500 rpm | | | | | |
| 97 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 98 | Exh-1 | 0.02441 | 0.722189349 | 1.197156934 | 24781.75901 | 1560188.999 |
| 99 | Exh-3 | 0.07066 | 2.090532544 | 1.605484147 | 26291.59883 | 1655244.216 |
| 100 | Exh-5 | 0.02929 | 0.866568047 | 1.216529903 | 22682.26202 | 1428010.645 |
| 101 | Exh-7 | 0.05127 | 1.516863905 | 1.432256977 | 25868.22008 | 1628589.495 |
| 102 | Exh-9 | 0.03418 | 1.011242604 | 1.316980432 | 28454.32239 | 1791403.135 |
| 103 | Exh-11 | 0.015 | 0.443786982 | 1.101481632 | 20757.92966 | 1306860.158 |
| 104 | Exh-13 | 0.03662 | 1.083431953 | 1.314388736 | 26341.25673 | 1658370.536 |
| 105 | Exh-17 | 0.06104 | 1.80591716 | 1.559435432 | 28120.51676 | 1770387.682 |
| 106 | Exh-19 | 0.02442 | 0.722485207 | 1.165919283 | 20846.78342 | 1312454.138 |
| 107 | | | | | | |
| 108 | #303 Mobil 1 Motored 2000 rpm | | | | | |
| 109 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 110 | Exh-1 | 0.04638 | 1.372189349 | 1.433701141 | 30528.1043 | 2408415.934 |
| 111 | Exh-3 | 0.0415 | 1.227810651 | 1.379827933 | 29879.87804 | 2357276.222 |
| 112 | Exh-5 | 0.02441 | 0.722189349 | 1.167077344 | 22345.48579 | 1762874.743 |
| 113 | Exh-7 | 0.03906 | 1.155621302 | 1.362001854 | 30256.49188 | 2386987.952 |
| 114 | Exh-9 | 0.083009 | 2.455887574 | 1.84667639 | 33299.08379 | 2627023.388 |
| 115 | Exh-11 | 0.02685 | 0.794378698 | 1.223899266 | 27223.77814 | 2147731.821 |
| 116 | Exh-13 | 0.03418 | 1.011242604 | 1.299719397 | 28627.45944 | 2258470.712 |
| 117 | Exh-17 | 0.05371 | 1.589053254 | 1.518536397 | 31518.39616 | 2486541.803 |
| 118 | Exh-19 | 0.03672 | 1.086390533 | 1.315030885 | 28008.54045 | 2209643.102 |
| 119 | Exh-21 | 0.04639 | 1.372485207 | 1.47800103 | 33639.10844 | 2653848.532 |
| 120 | Exh-23 | 0.0415 | 1.227810651 | 1.357820314 | 28148.6073 | 2220693.223 |
| 121 | Exh-25 | 0.03418 | 1.011242604 | 1.258508546 | 24691.23789 | 1947935.259 |
| 122 | Exh-27 | 0.03662 | 1.083431953 | 1.281389273 | 25085.87271 | 1979068.695 |
| 123 | | | | | | |
| 124 | #352 PENNZOIL 15W-40 MOTORED 1500 RPM | | | | | |
| 125 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 126 | Exh-1 | 0.03174 | 0.994984326 | 1.226941227 | 21874.63626 | 1303507.079 |
| 127 | Exh-3 | 0.02685 | 0.84169279 | 1.162490922 | 18514.80651 | 1103295.207 |
| 128 | Exh-5 | 0.03418 | 1.071473354 | 1.276828379 | 24778.3804 | 1476540.86 |
| 129 | Exh-7 | 0.05371 | 1.68369906 | 1.393134241 | 22393.40234 | 1334420.29 |
| 130 | Exh-11 | 0.05371 | 1.68369906 | 1.378346013 | 21551.04697 | 1284224.429 |
| 131 | Exh-13 | 0.03174 | 0.994984326 | 1.225346113 | 21720.88482 | 1294345.048 |
| 132 | Exh-15 | 0.09033 | 2.831661442 | 1.681427278 | 23079.25941 | 1375290.435 |
| 133 | Exh-17 | 0.02442 | 0.765517241 | 1.167374914 | 20969.0653 | 1249544.208 |
| 134 | Exh-19 | 0.03662 | 1.147962382 | 1.2968788 | 24802.48583 | 1477977.3 |
| 135 | Exh-21 | 0.01953 | 0.612225705 | 1.185188697 | 29009.9244 | 1728698.085 |
| 136 | | | | | | |
| 137 | #353 PENNZOIL 15W40 MOTORED 2000 RPM | | | | | |
| 138 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 139 | Exh-1 | 0.04394 | 1.377429467 | 1.407568871 | 28997.35264 | 2254688.804 |
| 140 | Exh-3 | 0.061036 | 1.913354232 | 1.691046601 | 35394.73515 | 2752117.205 |
| 141 | Exh-5 | 0.02685 | 0.84169279 | 1.218488079 | 25439.04783 | 1978012.857 |
| 142 | Exh-9 | 0.05127 | 1.607210031 | 1.450923483 | 27495.20306 | 2137889.182 |
| 143 | Exh-11 | 0.03034 | 0.951097179 | 1.273876151 | 28219.9367 | 2194240.838 |
| 144 | Exh-13 | 0.04395 | 1.377742947 | 1.349058852 | 24828.88244 | 1930569.454 |
| 145 | Exh-15 | 0.00976 | 0.305956113 | 1.077663722 | 24876.29973 | 1934256.386 |
| 146 | Exh-17 | 0.0122 | 0.382445141 | 1.090143343 | 23098.89602 | 1796054.382 |

| | AG | AH | AI | AJ | AK | AL |
|---|---|---|---|---|---|---|
| 147 | Exh-19 | 0.01465 | 0.459247649 | 1.113241091 | 24164.8341 | 1878936.384 |
| 148 | Exh-21 | 0.02197 | 0.688714734 | 1.188179872 | 26776.91296 | 2082038.544 |
| 149 | Exh-23 | 0.01709 | 0.535736677 | 1.139510204 | 25520.03745 | 1984310.204 |
| 150 | Exh-25 | 0.00977 | 0.306269592 | 1.068880429 | 22040.35947 | 1713747.885 |
| 151 | Exh-27 | 0.03174 | 0.994984326 | 1.257316579 | 25344.17988 | 1970636.4 |
| 152 | | | | | | |
| 153 | #401 Pennzoil SAE30 Motored 1000 rpm | | | | | |
| 154 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 155 | Exh-1 | 0.06104 | 1.56112532 | 1.593082005 | 24882.78931 | 1447444.617 |
| 156 | Exh-3 | 0.08301 | 2.123017903 | 1.79994218 | 24678.96961 | 1435588.32 |
| 157 | Exh-5 | 0.06592 | 1.685933504 | 1.658738883 | 25591.45274 | 1488667.932 |
| 158 | Exh-7 | 0.05372 | 1.373913043 | 1.497315312 | 23707.98626 | 1379105.721 |
| 159 | Exh-9 | 0.05127 | 1.311253197 | 1.510352379 | 25492.10309 | 1482888.712 |
| 160 | Exh-11 | 0.06104 | 1.56112532 | 1.582276066 | 24429.42551 | 1421072.212 |
| 161 | Exh-13 | 0.04395 | 1.124040921 | 1.378650814 | 22063.72599 | 1283458.258 |
| 162 | Exh-15 | 0.02441 | 0.624296675 | 1.195405059 | 20500.6138 | 1192531.22 |
| 163 | | | | | | |
| 164 | #402 Pennzoil SAE30 Motored 1500 rpm | | | | | |
| 165 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 166 | Exh-2 | 0.0122 | 0.31202046 | 1.107773852 | 25255.21021 | 1973997.35 |
| 167 | Exh-4 | 0.02442 | 0.62455243 | 1.193579073 | 22662.62224 | 1771355.529 |
| 168 | Exh-6 | 0.05127 | 1.311253197 | 1.461808683 | 25751.12408 | 2012758.962 |
| 169 | Exh-8 | 0.02441 | 0.624296675 | 1.181527478 | 21260.42831 | 1661757.269 |
| 170 | Exh-10 | 0.01465 | 0.374680307 | 1.120467067 | 23508.67359 | 1837484.582 |
| 171 | Exh-12 | 0.02929 | 0.749104859 | 1.232036758 | 22648.25949 | 1770232.908 |
| 172 | Exh-14 | 0.0293 | 0.749360614 | 1.236423788 | 23068.58545 | 1803086.42 |
| 173 | Exh-16 | 0.03907 | 0.999232737 | 1.321669685 | 23537.7062 | 1839753.828 |
| 174 | Exh-18 | 0.01954 | 0.499744246 | 1.166510439 | 24362.07751 | 1904188.326 |
| 175 | Exh-20 | 0.02442 | 0.62455243 | 1.206984235 | 24231.98674 | 1894020.173 |
| 176 | Exh-22 | 0.04395 | 1.124040921 | 1.329509672 | 21434.17151 | 1675337.382 |
| 177 | | | | | | |
| 178 | #403 Pennzoil SAE30 Motored 2000 rpm | | | | | |
| 179 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 180 | Exh-2 | 0.01708 | 0.436828645 | 1.133594056 | 23469.82457 | 2330402.816 |
| 181 | Exh-4 | 0.00244 | 0.062404092 | 1.018751921 | 23060.38327 | 2289747.925 |
| 182 | Exh-6 | 0.01708 | 0.436828645 | 1.138816645 | 24387.3299 | 2421505.202 |
| 183 | Exh-8 | 0.00489 | 0.125063939 | 1.045198262 | 27734.69887 | 2753877.438 |
| 184 | Exh-10 | 0.01465 | 0.374680307 | 1.1068719 | 21889.53218 | 2173489.933 |
| 185 | Exh-12 | 0.04638 | 1.186189258 | 1.43796034 | 28334.43882 | 2813427.762 |
| 186 | Exh-14 | 0.00977 | 0.249872123 | 1.067421158 | 20706.76331 | 2056048.582 |
| 187 | Exh-18 | 0.03418 | 0.874168798 | 1.260121766 | 22835.74636 | 2267442.922 |
| 188 | Exh-22 | 0.02441 | 0.624296675 | 1.190897005 | 23466.15368 | 2330038.32 |
| 189 | Exh-24 | 0.02685 | 0.686700767 | 1.253948737 | 28379.99689 | 2817951.386 |
| 190 | Exh-26 | 0.02442 | 0.62455243 | 1.188804701 | 23199.45161 | 2303556.518 |
| 191 | Exh-28 | 0.0293 | 0.749360614 | 1.279686903 | 28642.77464 | 2844043.528 |
| 192 | | | | | | |
| 193 | #404 Pennzoil SAE30 Motored 2500 rpm | | | | | |
| 194 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | tau (N/m^2) | Shear rate (1/s) |
| 195 | Exh-3 | 0.03662 | 0.93657289 | 1.288960783 | 28683.54495 | 2938747.731 |
| 196 | Exh-5 | 0.04394 | 1.123785166 | 1.314328636 | 26003.7603 | 2664192.718 |
| 197 | Exh-9 | 0.04151 | 1.061636829 | 1.304973918 | 26706.8228 | 2736224.377 |
| 198 | Exh-17 | 0.02197 | 0.561892583 | 1.129418002 | 21412.9692 | 2193847.196 |
| 199 | Exh-19 | 0.02198 | 0.562148338 | 1.129775049 | 21462.2758 | 2198898.86 |
| 200 | Exh-21 | 0.00987 | 0.252429668 | 1.083284111 | 30673.07106 | 3142582.904 |
| 201 | Exh-23 | 0.01464 | 0.374424552 | 1.087231127 | 21659.21261 | 2219075.851 |
| 202 | Exh-27 | 0.04637 | 1.185933504 | 1.340005866 | 26653.94964 | 2730807.303 |

## APPENDIX C - Compression Stroke Spreadsheet

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 4 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 5 | Comp-2 | 0.202081 | 10.698 | 0.097098 | 0.16057 | 11.697 | 0.104983 | 0.999 |
| 6 | Comp-4 | 0.26468 | 10.608 | 0.079138 | 0.17923 | 11.812 | 0.185542 | 1.204 |
| 7 | Comp-6 | 0.25499 | 10.602 | 0.079211 | 0.15245 | 11.678 | 0.175779 | 1.076 |
| 8 | Comp-8 | 0.20935 | 10.659 | 0.07996 | 0.18982 | 11.671 | 0.12939 | 1.012 |
| 9 | Comp-10 | 0.21431 | 10.621 | 0.082474 | 0.18013 | 11.746 | 0.131836 | 1.125 |
| 10 | Comp-12 | 0.23754 | 10.659 | 0.083731 | 0.16674 | 11.69 | 0.153809 | 1.031 |
| 11 | Comp-14 | 0.23582 | 10.514 | 0.089339 | 0.20653 | 11.697 | 0.146481 | 1.183 |
| 12 | | | | | | | | |
| 13 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 14 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 15 | Comp-2 | 0.15564 | 10.64 | 0.075077 | 0.141 | 11.822 | 0.080563 | 1.182 |
| 16 | Comp-6 | 0.14271 | 10.785 | 0.069469 | 0.12074 | 11.649 | 0.073241 | 0.864 |
| 17 | Comp-8 | 0.20043 | 10.64 | 0.080806 | 0.11254 | 11.778 | 0.119624 | 1.138 |
| 18 | Comp-10 | 0.17926 | 10.814 | 0.098686 | 0.13531 | 11.793 | 0.080574 | 0.979 |
| 19 | Comp-12 | 0.17807 | 10.611 | 0.097509 | 0.1146 | 11.793 | 0.080561 | 1.182 |
| 20 | Comp-14 | 0.15473 | 10.785 | 0.071717 | 0.11566 | 11.851 | 0.083013 | 1.066 |
| 21 | Comp-16 | 0.15692 | 10.698 | 0.088565 | 0.13251 | 11.778 | 0.068355 | 1.08 |
| 22 | Comp-18 | 0.17343 | 10.272 | 0.090427 | 0.11972 | 11.613 | 0.083003 | 1.341 |
| 23 | Comp-20 | 0.18349 | 10.785 | 0.10537 | 0.13222 | 11.806 | 0.07812 | 1.021 |
| 24 | Comp-22 | 0.17747 | 10.703 | 0.089581 | 0.10911 | 11.793 | 0.087889 | 1.09 |
| 25 | | | | | | | | |
| 26 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 27 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 28 | Comp-6 | 0.12589 | 10.664 | 0.094149 | 0.11124 | 11.527 | 0.031741 | 0.863 |
| 29 | Comp-8 | 0.12456 | 10.776 | 0.073288 | 0.09282 | 11.725 | 0.051272 | 0.949 |
| 30 | Comp-12 | 0.14334 | 10.739 | 0.10184 | 0.1409 | 11.567 | 0.0415 | 0.828 |
| 31 | Comp-14 | 0.11907 | 10.776 | 0.09954 | 0.097098 | 11.671 | 0.01953 | 0.895 |
| 32 | Comp-16 | 0.15557 | 10.734 | 0.11407 | 0.123836 | 11.709 | 0.0415 | 0.975 |
| 33 | Comp-18 | 0.13222 | 10.701 | 0.085834 | 0.10292 | 11.646 | 0.046386 | 0.945 |
| 34 | Comp-20 | 0.14772 | 10.851 | 0.1266 | 0.13063 | 11.725 | 0.02112 | 0.874 |
| 35 | Comp-24 | 0.11837 | 10.655 | 0.079307 | 0.10372 | 11.709 | 0.039063 | 1.054 |
| 36 | Comp-28 | 0.13742 | 10.694 | 0.10568 | 0.113 | 11.709 | 0.03174 | 1.015 |
| 37 | | | | | | | | |
| 38 | #254 Havoline SAE30 Motored 2500 rpm | | | | | | | |
| 39 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 40 | Comp-2 | 0.16872 | 10.618 | 0.08083 | 0.09792 | 11.691 | 0.08789 | 1.073 |
| 41 | Comp-4 | 0.17447 | 10.541 | 0.10611 | 0.11832 | 11.719 | 0.06836 | 1.178 |
| 42 | Comp-6 | 0.18286 | 10.723 | 0.094971 | 0.11694 | 11.789 | 0.087889 | 1.066 |
| 43 | Comp-8 | 0.14969 | 10.618 | 0.083513 | 0.10793 | 11.643 | 0.066177 | 1.025 |
| 44 | Comp-10 | 0.13096 | 10.587 | 0.084577 | 0.11632 | 11.789 | 0.046383 | 1.202 |
| 45 | Comp-12 | 0.14373 | 10.765 | 0.099781 | 0.14373 | 11.691 | 0.043949 | 0.926 |
| 46 | Comp-16 | 0.15717 | 10.677 | 0.086636 | 0.12299 | 11.719 | 0.070534 | 1.042 |
| 47 | Comp-18 | 0.13751 | 10.765 | 0.091128 | 0.11066 | 11.81 | 0.046382 | 1.045 |
| 48 | Comp-20 | 0.12487 | 10.618 | 0.088251 | 0.11022 | 11.719 | 0.036619 | 1.101 |
| 49 | Comp-22 | 0.16057 | 10.667 | 0.10442 | 0.15325 | 11.691 | 0.05615 | 1.024 |
| 50 | Comp-26 | 0.13282 | 10.667 | 0.093762 | 0.11818 | 11.674 | 0.039058 | 1.007 |
| 51 | Comp-30 | 0.17571 | 10.765 | 0.10246 | 0.13664 | 11.691 | 0.07325 | 0.926 |
| 52 | Comp-32 | 0.13867 | 10.677 | 0.096566 | 0.14295 | 11.764 | 0.042104 | 1.087 |
| 53 | Comp-34 | 0.14196 | 10.723 | 0.1029 | 0.13708 | 11.643 | 0.03906 | 0.92 |
| 54 | | | | | | | | |
| 55 | #301 MOBIL 1 Motored 1000 RPM | | | | | | | |
| 56 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 57 | Comp-2 | 0.27549 | 10.691 | 0.12168 | 0.20225 | 11.868 | 0.15381 | 1.177 |
| 58 | Comp-4 | 0.30624 | 10.729 | 0.13046 | 0.16463 | 11.715 | 0.17578 | 0.986 |
| 59 | Comp-6 | 0.2802 | 10.71 | 0.10931 | 0.15813 | 11.849 | 0.17089 | 1.139 |
| 60 | Comp-8 | 0.25076 | 10.679 | 0.10428 | 0.16775 | 11.686 | 0.14648 | 1.007 |
| 61 | Comp-10 | 0.26152 | 10.641 | 0.11992 | 0.16386 | 11.868 | 0.1416 | 1.227 |
| 62 | Comp-12 | 0.27334 | 10.729 | 0.12197 | 0.1708 | 11.887 | 0.15137 | 1.158 |
| 63 | Comp-14 | 0.25818 | 10.621 | 0.12391 | 0.1825 | 11.845 | 0.13427 | 1.224 |
| 64 | | | | | | | | |
| 65 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 66 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 67 | Comp-2 | 0.23089 | 10.881 | 0.13324 | 0.1723 | 11.792 | 0.09765 | 0.911 |
| 68 | Comp-4 | 0.23137 | 10.554 | 0.10686 | 0.17766 | 11.899 | 0.12451 | 1.345 |
| 69 | Comp-6 | 0.24266 | 10.583 | 0.12304 | 0.19383 | 11.734 | 0.11962 | 1.151 |
| 70 | Comp-8 | 0.20534 | 10.633 | 0.12479 | 0.17849 | 11.792 | 0.08055 | 1.159 |
| 71 | Comp-10 | 0.2168 | 10.641 | 0.12158 | 0.20947 | 11.789 | 0.09522 | 1.148 |
| 72 | Comp-12 | 0.19645 | 10.612 | 0.10856 | 0.16471 | 11.763 | 0.08789 | 1.151 |
| 73 | Comp-14 | 0.22052 | 10.554 | 0.12042 | 0.16925 | 11.816 | 0.1001 | 1.262 |

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 74 | Comp-16 | 0.20851 | 10.641 | 0.11574 | 0.18653 | 11.763 | 0.09277 | 1.122 |
| 75 | Comp-18 | 0.20285 | 10.743 | 0.13938 | 0.18332 | 11.734 | 0.06347 | 0.991 |
| 76 | Comp-20 | 0.21902 | 10.641 | 0.10916 | 0.17996 | 11.792 | 0.10986 | 1.151 |
| 77 | Comp-22 | 0.23756 | 10.578 | 0.11793 | 0.15455 | 11.792 | 0.11963 | 1.214 |
| 78 | | | | | | | | |
| 79 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 80 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 81 | Comp-2 | 0.19867 | 10.579 | 0.10101 | 0.14496 | 11.734 | 0.09766 | 1.155 |
| 82 | Comp-4 | 0.20213 | 10.542 | 0.124 | 0.16795 | 11.734 | 0.07813 | 1.192 |
| 83 | Comp-6 | 0.21537 | 10.579 | 0.12748 | 0.17631 | 11.774 | 0.08789 | 1.195 |
| 84 | Comp-8 | 0.18071 | 10.507 | 0.10503 | 0.15874 | 11.813 | 0.07568 | 1.306 |
| 85 | Comp-10 | 0.20708 | 10.617 | 0.12896 | 0.15581 | 11.695 | 0.07812 | 1.078 |
| 86 | Comp-12 | 0.20121 | 10.542 | 0.12552 | 0.15726 | 11.66 | 0.07569 | 1.118 |
| 87 | Comp-14 | 0.22449 | 10.542 | 0.12195 | 0.19763 | 11.734 | 0.10254 | 1.192 |
| 88 | Comp-16 | 0.17198 | 10.579 | 0.10607 | 0.19396 | 11.734 | 0.06591 | 1.155 |
| 89 | Comp-18 | 0.1985 | 10.617 | 0.10573 | 0.157 | 11.771 | 0.09277 | 1.154 |
| 90 | Comp-20 | 0.19959 | 10.542 | 0.11902 | 0.15808 | 11.774 | 0.08057 | 1.232 |
| 91 | Comp-22 | 0.18131 | 10.579 | 0.1154 | 0.15934 | 11.655 | 0.06591 | 1.076 |
| 92 | Comp-26 | 0.19734 | 10.542 | 0.1189 | 0.17293 | 11.734 | 0.07844 | 1.192 |
| 93 | Comp-28 | 0.18523 | 10.542 | 0.10466 | 0.15349 | 11.808 | 0.08057 | 1.266 |
| 94 | | | | | | | | |
| 95 | #304 Mobil 1 Motored 2500 rpm | | | | | | | |
| 96 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 97 | Comp-1 | 0.14909 | 10.712 | 0.11247 | 0.15886 | 11.824 | 0.03662 | 1.112 |
| 98 | Comp-3 | 0.16945 | 10.694 | 0.10353 | 0.14991 | 11.869 | 0.06592 | 1.175 |
| 99 | Comp-5 | 0.15871 | 10.739 | 0.11477 | 0.13918 | 11.831 | 0.04394 | 1.092 |
| 100 | Comp-7 | 0.17725 | 10.712 | 0.12354 | 0.15772 | 11.689 | 0.05371 | 0.977 |
| 101 | Comp-11 | 0.15801 | 10.694 | 0.10674 | 0.15313 | 11.734 | 0.05127 | 1.04 |
| 102 | Comp-13 | 0.15221 | 10.712 | 0.11803 | 0.13756 | 11.779 | 0.03418 | 1.067 |
| 103 | Comp-17 | 0.14607 | 10.516 | 0.10701 | 0.14119 | 11.689 | 0.03906 | 1.173 |
| 104 | Comp-19 | 0.162551 | 10.513 | 0.11368 | 0.14298 | 11.734 | 0.048871 | 1.221 |
| 105 | Comp-21 | 0.16118 | 10.649 | 0.10503 | 0.13677 | 11.734 | 0.05615 | 1.085 |
| 106 | Comp-23 | 0.14772 | 10.614 | 0.11354 | 0.13795 | 11.831 | 0.03418 | 1.217 |
| 107 | Comp-25 | 0.15516 | 10.76 | 0.12586 | 0.15272 | 11.831 | 0.0293 | 1.071 |
| 108 | Comp-27 | 0.15231 | 10.663 | 0.11325 | 0.15231 | 11.734 | 0.03906 | 1.071 |
| 109 | Comp-29 | 0.15342 | 10.663 | 0.12901 | 0.16563 | 11.689 | 0.02441 | 1.026 |
| 110 | Comp-31 | 0.1531 | 10.649 | 0.10428 | 0.1531 | 11.739 | 0.04882 | 1.09 |
| 111 | | | | | | | | |
| 112 | #352 Pennzoil 15W40 Motored 1500 rpm | | | | | | | |
| 113 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 114 | Comp-2 | 0.19115 | 10.272 | 0.10814 | 0.14232 | 11.541 | 0.08301 | 1.269 |
| 115 | Comp-4 | 0.16309 | 10.358 | 0.11914 | 0.15088 | 11.486 | 0.04395 | 1.128 |
| 116 | Comp-6 | 0.19151 | 10.358 | 0.14757 | 0.21105 | 11.445 | 0.04394 | 1.087 |
| 117 | Comp-8 | 0.16855 | 10.3 | 0.12216 | 0.16123 | 11.388 | 0.04639 | 1.088 |
| 118 | Comp-10 | 0.17948 | 10.358 | 0.12821 | 0.16483 | 11.474 | 0.05127 | 1.116 |
| 119 | Comp-12 | 0.17167 | 10.358 | 0.11063 | 0.17899 | 11.35 | 0.06104 | 0.992 |
| 120 | Comp-16 | 0.19603 | 10.3 | 0.11791 | 0.13744 | 11.474 | 0.07812 | 1.174 |
| 121 | Comp-18 | 0.19603 | 10.329 | 0.11791 | 0.13012 | 11.388 | 0.07812 | 1.059 |
| 122 | Comp-22 | 0.14798 | 10.329 | 0.10159 | 0.1553 | 11.445 | 0.04639 | 1.116 |
| 123 | | | | | | | | |
| 124 | #353 Pennzoil 15W40 Motored 2000 rpm | | | | | | | |
| 125 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 126 | Comp-6 | 0.17675 | 10.343 | 0.11571 | 0.1328 | 11.353 | 0.06104 | 1.01 |
| 127 | Comp-8 | 0.15163 | 10.422 | 0.10524 | 0.14919 | 11.427 | 0.04639 | 1.005 |
| 128 | Comp-10 | 0.16625 | 10.353 | 0.08813 | 0.11987 | 11.39 | 0.07812 | 1.037 |
| 129 | Comp-12 | 0.17116 | 10.383 | 0.095479 | 0.12233 | 11.39 | 0.075681 | 1.007 |
| 130 | Comp-14 | 0.17459 | 10.278 | 0.12333 | 0.18924 | 11.427 | 0.05126 | 1.149 |
| 131 | Comp-16 | 0.16333 | 10.353 | 0.1145 | 0.13403 | 11.427 | 0.04883 | 1.074 |
| 132 | Comp-18 | 0.14619 | 10.278 | 0.11201 | 0.15107 | 11.427 | 0.03418 | 1.149 |
| 133 | Comp-20 | 0.17116 | 10.353 | 0.11745 | 0.11989 | 11.445 | 0.05371 | 1.092 |
| 134 | Comp-22 | 0.13367 | 10.343 | 0.084843 | 0.11658 | 11.464 | 0.048827 | 1.121 |
| 135 | Comp-24 | 0.1458 | 10.278 | 0.10674 | 0.11651 | 11.353 | 0.03906 | 1.075 |
| 136 | Comp-26 | 0.16633 | 10.315 | 0.11994 | 0.14191 | 11.39 | 0.04639 | 1.075 |
| 137 | Comp-28 | 0.1474 | 10.278 | 0.11078 | 0.15228 | 11.427 | 0.03662 | 1.149 |
| 138 | | | | | | | | |
| 139 | #354 Pennzoil 15W40 Motored 2500 rpm | | | | | | | |
| 140 | Stroke/rev | Inlet (volts) | Inlet (mm) | h min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 141 | Comp-2 | 0.1291 | 10.456 | 0.092481 | 0.10957 | 11.421 | 0.036619 | 0.965 |
| 142 | Comp-4 | 0.141015 | 10.321 | 0.10109 | 0.12062 | 11.445 | 0.039925 | 1.124 |
| 143 | Comp-8 | 0.14119 | 10.456 | 0.11677 | 0.14363 | 11.518 | 0.02442 | 1.062 |
| 144 | Comp-10 | 0.13239 | 10.456 | 0.11286 | 0.13239 | 11.445 | 0.01953 | 0.989 |
| 145 | Comp-12 | 0.12301 | 10.355 | 0.098597 | 0.14254 | 11.373 | 0.024413 | 1.018 |
| 146 | Comp-18 | 0.13282 | 10.404 | 0.11085 | 0.15236 | 11.421 | 0.02197 | 1.017 |

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 147 | Comp-20 | 0.13321 | 10.355 | 0.11368 | 0.14542 | 11.445 | 0.01953 | 1.09 |
| 148 | Comp-26 | 0.12195 | 10.453 | 0.09265 | 0.12927 | 11.421 | 0.0293 | 0.968 |
| 149 | Comp-32 | 0.13418 | 10.321 | 0.097557 | 0.13174 | 11.366 | 0.036623 | 1.245 |
| 150 | | | | | | | | |
| 151 | #401 Pennzoil SAE30 Motored 1000 rpm | | | | | | | |
| 152 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 153 | Comp-2 | 0.18666 | 10.524 | 0.1305 | 0.19388 | 11.613 | 0.05616 | 1.089 |
| 154 | Comp-4 | 0.17537 | 10.448 | 0.11433 | 0.20466 | 11.613 | 0.06104 | 1.165 |
| 155 | Comp-6 | 0.18719 | 10.543 | 0.12615 | 0.17498 | 11.609 | 0.06104 | 1.066 |
| 156 | Comp-8 | 0.18886 | 10.62 | 0.12538 | 0.17421 | 11.632 | 0.06348 | 1.012 |
| 157 | Comp-10 | 0.18397 | 10.563 | 0.12538 | 0.16688 | 11.494 | 0.05859 | 0.931 |
| 158 | Comp-12 | 0.20889 | 10.448 | 0.13807 | 0.18692 | 11.632 | 0.07082 | 1.184 |
| 159 | Comp-14 | 0.19333 | 10.563 | 0.12985 | 0.186 | 11.651 | 0.06348 | 1.088 |
| 160 | | | | | | | | |
| 161 | #402 Pennzoil SAE30 Motored 1500 rpm | | | | | | | |
| 162 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | b (mm) |
| 163 | Comp-1 | 0.22127 | 10.332 | 0.12117 | 0.16268 | 11.48 | 0.1001 | 1.148 |
| 164 | Comp-3 | 0.22195 | 10.448 | 0.11697 | 0.15847 | 11.589 | 0.10498 | 1.141 |
| 165 | Comp-5 | 0.23693 | 10.39 | 0.11975 | 0.15881 | 11.68 | 0.11718 | 1.29 |
| 166 | Comp-7 | 0.2233 | 10.361 | 0.10367 | 0.15494 | 11.451 | 0.11963 | 1.09 |
| 167 | Comp-9 | 0.23884 | 10.332 | 0.11433 | 0.13875 | 11.623 | 0.12451 | 1.291 |
| 168 | Comp-11 | 0.25381 | 10.419 | 0.13174 | 0.15371 | 11.671 | 0.12207 | 1.252 |
| 169 | Comp-13 | 0.25516 | 10.419 | 0.10379 | 0.17459 | 11.566 | 0.15137 | 1.147 |
| 170 | Comp-15 | 0.21859 | 10.419 | 0.11605 | 0.17708 | 11.617 | 0.10254 | 1.198 |
| 171 | Comp-17 | 0.21946 | 10.41 | 0.094947 | 0.16331 | 11.623 | 0.124513 | 1.213 |
| 172 | Comp-19 | 0.21201 | 10.304 | 0.10703 | 0.15098 | 11.698 | 0.10498 | 1.394 |
| 173 | Comp-21 | 0.25356 | 10.448 | 0.1315 | 0.15591 | 11.566 | 0.12206 | 1.118 |
| 174 | | | | | | | | |
| 175 | #403 Pennzoil SAE30 Motored 2000 rpm | | | | | | | |
| 176 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | B (mm) |
| 177 | Comp-1 | 0.22596 | 10.366 | 0.12098 | 0.17713 | 11.554 | 0.10498 | 1.188 |
| 178 | Comp-3 | 0.21936 | 10.415 | 0.10462 | 0.14368 | 11.554 | 0.11474 | 1.139 |
| 179 | Comp-5 | 0.21851 | 10.255 | 0.13307 | 0.17213 | 11.441 | 0.08544 | 1.186 |
| 180 | Comp-7 | 0.22519 | 10.336 | 0.11777 | 0.15194 | 11.517 | 0.10742 | 1.181 |
| 181 | Comp-9 | 0.23486 | 10.329 | 0.12988 | 0.16161 | 11.554 | 0.10498 | 1.225 |
| 182 | Comp-11 | 0.22816 | 10.329 | 0.14027 | 0.16712 | 11.554 | 0.08789 | 1.225 |
| 183 | Comp-13 | 0.20841 | 10.336 | 0.13029 | 0.16935 | 11.554 | 0.07812 | 1.218 |
| 184 | Comp-15 | 0.18726 | 10.441 | 0.11402 | 0.14331 | 11.519 | 0.07324 | 1.078 |
| 185 | Comp-17 | 0.19463 | 10.415 | 0.12627 | 0.16045 | 11.48 | 0.06836 | 1.065 |
| 186 | Comp-19 | 0.23957 | 10.366 | 0.13215 | 0.17853 | 11.48 | 0.10742 | 1.114 |
| 187 | Comp-21 | 0.22886 | 10.441 | 0.13365 | 0.1605 | 11.628 | 0.09521 | 1.187 |
| 188 | Comp-23 | 0.19582 | 10.441 | 0.13996 | 0.21291 | 11.519 | 0.05586 | 1.078 |
| 189 | Comp-25 | 0.23224 | 10.441 | 0.11994 | 0.15168 | 11.517 | 0.1123 | 1.076 |
| 190 | | | | | | | | |
| 191 | #404 Pennzoil SAE30 Motored 2500 rpm | | | | | | | |
| 192 | Stroke/Rev | Inlet (volts) | Inlet (mm) | H min (volts) | Outlet (volts) | Outlet (mm) | Delta (volts) | B (mm) |
| 193 | Comp-2 | 0.17907 | 10.461 | 0.12536 | 0.14245 | 11.577 | 0.05371 | 1.116 |
| 194 | Comp-4 | 0.17788 | 10.443 | 0.15591 | 0.18276 | 11.528 | 0.02197 | 1.085 |
| 195 | Comp-6 | 0.15417 | 10.461 | 0.11999 | 0.15661 | 11.57 | 0.03418 | 1.109 |
| 196 | Comp-10 | 0.16727 | 10.489 | 0.13553 | 0.17704 | 11.431 | 0.03174 | 0.942 |
| 197 | Comp-12 | 0.1831 | 10.461 | 0.14892 | 0.17578 | 11.525 | 0.03418 | 1.064 |
| 198 | Comp-20 | 0.16132 | 10.534 | 0.13935 | 0.16865 | 11.48 | 0.02197 | 0.946 |
| 199 | Comp-22 | 0.1672 | 10.489 | 0.13302 | 0.16231 | 11.48 | 0.03418 | 0.991 |
| 200 | Comp-26 | 0.16998 | 10.469 | 0.13336 | 0.18218 | 11.435 | 0.03662 | 0.966 |
| 201 | Comp-30 | 0.16857 | 10.558 | 0.13928 | 0.16125 | 11.525 | 0.02929 | 0.967 |
| 202 | Comp-32 | 0.16628 | 10.461 | 0.12478 | 0.18093 | 11.525 | 0.0415 | 1.064 |

| | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 4 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 5 | Comp-2 | 35.6 | 2.948960674 | 2.72747191 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 6 | Comp-4 | 35.6 | 5.211853933 | 2.222977528 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 7 | Comp-6 | 35.6 | 4.93761236 | 2.22502809 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 8 | Comp-8 | 35.6 | 3.634550562 | 2.246067416 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 9 | Comp-10 | 35.6 | 3.703258427 | 2.316685393 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 10 | Comp-12 | 35.6 | 4.320477528 | 2.351994382 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 11 | Comp-14 | 35.6 | 4.114634831 | 2.509522472 | 511110 | 73 | 17.10375498 | 0.017103755 |
| 12 | | | | | | | | |
| 13 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 14 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 15 | Comp-2 | 35.6 | 2.263005618 | 2.108904494 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 16 | Comp-6 | 35.6 | 2.057331461 | 1.951376404 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 17 | Comp-8 | 35.6 | 3.360224719 | 2.269831461 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 18 | Comp-10 | 35.6 | 2.263314607 | 2.772078652 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 19 | Comp-12 | 35.6 | 2.262949438 | 2.739016854 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 20 | Comp-14 | 35.6 | 2.331825843 | 2.014522472 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 21 | Comp-16 | 35.6 | 1.92008427 | 2.487780899 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 22 | Comp-18 | 35.6 | 2.331544944 | 2.54008427 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 23 | Comp-20 | 35.6 | 2.194382022 | 2.959831461 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 24 | Comp-22 | 35.6 | 2.468792135 | 2.516320225 | 511111 | 83.3 | 12.5655416 | 0.012565542 |
| 25 | | | | | | | | |
| 26 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 27 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 28 | Comp-6 | 35.6 | 0.891601124 | 2.644634831 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 29 | Comp-8 | 35.6 | 1.440224719 | 2.058651685 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 30 | Comp-12 | 35.6 | 1.165730337 | 2.860674157 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 31 | Comp-14 | 35.6 | 0.548595506 | 2.796067416 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 32 | Comp-16 | 35.6 | 1.165730337 | 3.204213483 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 33 | Comp-18 | 35.6 | 1.302977528 | 2.411067416 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 34 | Comp-20 | 35.6 | 0.593258427 | 3.556179775 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 35 | Comp-24 | 35.6 | 1.097275281 | 2.227724719 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 36 | Comp-28 | 35.6 | 0.891573034 | 2.968539326 | 470542 | 92.7 | 9.788249549 | 0.00978825 |
| 37 | | | | | | | | |
| 38 | #254 Havoline SAE30 Motored 2500 rpm | | | | | | | |
| 39 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | h min (μm) | W (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 40 | Comp-2 | 35.6 | 2.468820225 | 2.270505618 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 41 | Comp-4 | 35.6 | 1.920224719 | 2.980617978 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 42 | Comp-6 | 35.6 | 2.468792135 | 2.667724719 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 43 | Comp-8 | 35.6 | 1.858904494 | 2.345870787 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 44 | Comp-10 | 35.6 | 1.302893258 | 2.375758427 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 45 | Comp-12 | 35.6 | 1.234522472 | 2.802837079 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 46 | Comp-16 | 35.6 | 1.981292135 | 2.433595506 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 47 | Comp-18 | 35.6 | 1.302865169 | 2.559775281 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 48 | Comp-20 | 35.6 | 1.028623596 | 2.478960674 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 49 | Comp-22 | 35.6 | 1.577247191 | 2.933146067 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 50 | Comp-26 | 35.6 | 1.097134831 | 2.633764045 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 51 | Comp-30 | 35.6 | 2.05758427 | 2.878089888 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 52 | Comp-32 | 35.6 | 1.182696629 | 2.71252809 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 53 | Comp-34 | 35.6 | 1.097191011 | 2.890449438 | 470426 | 101.3 | 7.956018324 | 0.007956018 |
| 54 | | | | | | | | |
| 55 | #301 Mobil 1 Motored 1000 rpm | | | | | | | |
| 56 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 57 | Comp-2 | 33.8 | 4.550591716 | 3.6 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 58 | Comp-4 | 33.8 | 5.200591716 | 3.859763314 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 59 | Comp-6 | 33.8 | 5.05591716 | 3.234023669 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 60 | Comp-8 | 33.8 | 4.333727811 | 3.085207101 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 61 | Comp-10 | 33.8 | 4.189349112 | 3.547928994 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 62 | Comp-12 | 33.8 | 4.478402367 | 3.608579882 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 63 | Comp-14 | 33.8 | 3.972485207 | 3.665976331 | 511110 | 73 | 20.98534438 | 0.020985344 |
| 64 | | | | | | | | |
| 65 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 66 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 67 | Comp-2 | 33.8 | 2.889053254 | 3.942011834 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 68 | Comp-4 | 33.8 | 3.683727811 | 3.161538462 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 69 | Comp-6 | 33.8 | 3.539053254 | 3.640236686 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 70 | Comp-8 | 33.8 | 2.383136095 | 3.692011834 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 71 | Comp-10 | 33.8 | 2.817159763 | 3.59704142 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 72 | Comp-12 | 33.8 | 2.600295858 | 3.21183432 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 73 | Comp-14 | 33.8 | 2.961538462 | 3.562721893 | 511111 | 83.3 | 15.88381858 | 0.015883819 |

| | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|
| 74 | Comp-16 | 33.8 | 2.744674556 | 3.424260355 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 75 | Comp-18 | 33.8 | 1.877810651 | 4.123668639 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 76 | Comp-20 | 33.8 | 3.250295858 | 3.229585799 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 77 | Comp-22 | 33.8 | 3.539349112 | 3.489053254 | 511111 | 83.3 | 15.88381858 | 0.015883819 |
| 78 | | | | | | | | |
| 79 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 80 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 81 | Comp-2 | 33.8 | 2.889349112 | 2.988461538 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 82 | Comp-4 | 33.8 | 2.311538462 | 3.668639053 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 83 | Comp-6 | 33.8 | 2.600295858 | 3.771597633 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 84 | Comp-8 | 33.8 | 2.239053254 | 3.10739645 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 85 | Comp-10 | 33.8 | 2.311242604 | 3.815384615 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 86 | Comp-12 | 33.8 | 2.239349112 | 3.713609467 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 87 | Comp-14 | 33.8 | 3.033727811 | 3.607988166 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 88 | Comp-16 | 33.8 | 1.95 | 3.13816568 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 89 | Comp-18 | 33.8 | 2.744674556 | 3.128106509 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 90 | Comp-20 | 33.8 | 2.383727811 | 3.521301775 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 91 | Comp-22 | 33.8 | 1.95 | 3.414201183 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 92 | Comp-26 | 33.8 | 2.320710059 | 3.517751479 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 93 | Comp-28 | 33.8 | 2.383727811 | 3.096449704 | 470542 | 92.7 | 12.67559472 | 0.012675595 |
| 94 | | | | | | | | |
| 95 | #304 Mobil 1 Motored 2500 rpm | | | | | | | |
| 96 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 97 | Comp-1 | 33.8 | 1.083431953 | 3.327514793 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 98 | Comp-3 | 33.8 | 1.950295858 | 3.063017751 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 99 | Comp-5 | 33.8 | 1.3 | 3.39556213 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 100 | Comp-7 | 33.8 | 1.589053254 | 3.655029586 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 101 | Comp-11 | 33.8 | 1.516863905 | 3.157988166 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 102 | Comp-13 | 33.8 | 1.011242604 | 3.492011834 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 103 | Comp-17 | 33.8 | 1.155621302 | 3.165976331 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 104 | Comp-19 | 33.8 | 1.445887574 | 3.363313609 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 105 | Comp-21 | 33.8 | 1.661242604 | 3.10739645 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 106 | Comp-23 | 33.8 | 1.011242604 | 3.359171598 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 107 | Comp-25 | 33.8 | 0.866863905 | 3.723668639 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 108 | Comp-27 | 33.8 | 1.155621302 | 3.350591716 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 109 | Comp-29 | 33.8 | 0.722189349 | 3.816863905 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 110 | Comp-31 | 33.8 | 1.444378698 | 3.085207101 | 470426 | 101.3 | 10.51145773 | 0.010511458 |
| 111 | | | | | | | | |
| 112 | #352 Pennzoil 15W40 Motored 1500 rpm | | | | | | | |
| 113 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (C) | μ (CP) | μ (Pa-s) |
| 114 | Comp-2 | 31.9 | 2.602194357 | 3.389968652 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 115 | Comp-4 | 31.9 | 1.377742947 | 3.734796238 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 116 | Comp-6 | 31.9 | 1.377429467 | 4.626018809 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 117 | Comp-8 | 31.9 | 1.454231975 | 3.829467085 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 118 | Comp-10 | 31.9 | 1.607210031 | 4.019122257 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 119 | Comp-12 | 31.9 | 1.913479624 | 3.468025078 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 120 | Comp-16 | 31.9 | 2.448902821 | 3.696238245 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 121 | Comp-18 | 31.9 | 2.448902821 | 3.696238245 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 122 | Comp-22 | 31.9 | 1.454231975 | 3.184639498 | 511111 | 73 | 16.78137129 | 0.016781371 |
| 123 | | | | | | | | |
| 124 | #352 Pennzoil 15W40 Motored 2000 rpm | | | | | | | |
| 125 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 126 | Comp-6 | 31.9 | 1.913479624 | 3.627272727 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 127 | Comp-8 | 31.9 | 1.454231975 | 3.299059561 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 128 | Comp-10 | 31.9 | 2.448902821 | 2.762695925 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 129 | Comp-12 | 31.9 | 2.372445141 | 2.9930721 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 130 | Comp-14 | 31.9 | 1.606896552 | 3.866144201 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 131 | Comp-16 | 31.9 | 1.530721003 | 3.589341693 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 132 | Comp-18 | 31.9 | 1.071473354 | 3.511285266 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 133 | Comp-20 | 31.9 | 1.68369906 | 3.681818182 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 134 | Comp-22 | 31.9 | 1.530626959 | 2.659655172 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 135 | Comp-24 | 31.9 | 1.224451411 | 3.346081505 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 136 | Comp-26 | 31.9 | 1.454231975 | 3.759874608 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 137 | Comp-28 | 31.9 | 1.147962382 | 3.472727273 | 470542 | 83.3 | 12.86091126 | 0.012860911 |
| 138 | | | | | | | | |
| 139 | #352 Pennzoil 15W40 Motored 2500 rpm | | | | | | | |
| 140 | Stroke/rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa-s) |
| 141 | Comp-2 | 31.9 | 1.147931034 | 2.899090909 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 142 | Comp-4 | 31.9 | 1.251567398 | 3.168965517 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 143 | Comp-8 | 31.9 | 0.765517241 | 3.660501567 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 144 | Comp-10 | 31.9 | 0.612225705 | 3.537931034 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 145 | Comp-12 | 31.9 | 0.765297806 | 3.090815047 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 146 | Comp-18 | 31.9 | 0.688714734 | 3.47492163 | 470426 | 101.3 | 8.669457444 | 0.008669457 |

| | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|
| 147 | Comp-20 | 31.9 | 0.612225705 | 3.563636364 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 148 | Comp-26 | 31.9 | 0.918495298 | 2.904388715 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 149 | Comp-32 | 31.9 | 1.148056426 | 3.058213166 | 470426 | 101.3 | 8.669457444 | 0.008669457 |
| 150 | | | | | | | | |
| 151 | #401 Pennzoil SAE30 Motored 1000 rpm | | | | | | | |
| 152 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | h min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa•s) |
| 153 | Comp-2 | 31.9 | 1.760501567 | 4.090909091 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 154 | Comp-4 | 31.9 | 1.913479624 | 3.584012539 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 155 | Comp-6 | 31.9 | 1.913479624 | 3.954545455 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 156 | Comp-8 | 31.9 | 1.989968652 | 3.930407524 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 157 | Comp-10 | 31.9 | 1.836677116 | 3.930407524 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 158 | Comp-12 | 31.9 | 2.220062696 | 4.328213166 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 159 | Comp-14 | 31.9 | 1.989968652 | 4.070532915 | 511110 | 73 | 17.19084034 | 0.01719084 |
| 160 | | | | | | | | |
| 161 | #402 Pennzoil SAE30 Motored 1500 rpm | | | | | | | |
| 162 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | H min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa•s) |
| 163 | Comp-1 | 31.9 | 3.137931034 | 3.798432602 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 164 | Comp-3 | 31.9 | 3.290909091 | 3.66677116 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 165 | Comp-5 | 31.9 | 3.673354232 | 3.753918495 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 166 | Comp-7 | 31.9 | 3.75015674 | 3.24984326 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 167 | Comp-9 | 31.9 | 3.903134796 | 3.584012539 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 168 | Comp-11 | 31.9 | 3.826645768 | 4.129780564 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 169 | Comp-13 | 31.9 | 4.745141066 | 3.253605016 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 170 | Comp-15 | 31.9 | 3.214420063 | 3.637931034 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 171 | Comp-17 | 31.9 | 3.90322884 | 2.976394984 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 172 | Comp-19 | 31.9 | 3.290909091 | 3.355172414 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 173 | Comp-21 | 31.9 | 3.826332288 | 4.122257053 | 511111 | 83.3 | 12.79394332 | 0.012793943 |
| 174 | | | | | | | | |
| 175 | #403 Pennzoil SAE30 Motored 2000 rpm | | | | | | | |
| 176 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | H min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa•s) |
| 177 | Comp-1 | 31.9 | 3.290909091 | 3.792476489 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 178 | Comp-3 | 31.9 | 3.596865204 | 3.279623824 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 179 | Comp-5 | 31.9 | 2.678369906 | 4.171473354 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 180 | Comp-7 | 31.9 | 3.367398119 | 3.69184953 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 181 | Comp-9 | 31.9 | 3.290909091 | 4.071473354 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 182 | Comp-11 | 31.9 | 2.755172414 | 4.397178683 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 183 | Comp-13 | 31.9 | 2.448902821 | 4.084326019 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 184 | Comp-15 | 31.9 | 2.295924765 | 3.574294671 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 185 | Comp-17 | 31.9 | 2.142946708 | 3.95830721 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 186 | Comp-19 | 31.9 | 3.367398119 | 4.142633229 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 187 | Comp-21 | 31.9 | 2.984639498 | 4.189655172 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 188 | Comp-23 | 31.9 | 1.751097179 | 4.387460815 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 189 | Comp-25 | 31.9 | 3.520376176 | 3.759874608 | 470542 | 92.7 | 10.07114496 | 0.010071145 |
| 190 | | | | | | | | |
| 191 | #404 Pennzoil SAE30 Motored 2500 rpm | | | | | | | |
| 192 | Stroke/Rev | Cal (mV/μm) | Delta (μm) | H min (μm) | ΔP (Pa) | Oil Temp (°C) | μ (CP) | μ (Pa•s) |
| 193 | Comp-2 | 31.9 | 1.68369906 | 3.929780564 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 194 | Comp-4 | 31.9 | 0.688714734 | 4.887460815 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 195 | Comp-6 | 31.9 | 1.071473354 | 3.761442006 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 196 | Comp-10 | 31.9 | 0.994984326 | 4.248589342 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 197 | Comp-12 | 31.9 | 1.071473354 | 4.668338558 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 198 | Comp-20 | 31.9 | 0.688714734 | 4.368338558 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 199 | Comp-22 | 31.9 | 1.071473354 | 4.169905956 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 200 | Comp-26 | 31.9 | 1.147962382 | 4.180564263 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 201 | Comp-30 | 31.9 | 0.918181818 | 4.366144201 | 470426 | 101.3 | 8.2574414 | 0.009760465 |
| 202 | Comp-32 | 31.9 | 1.300940439 | 3.911598746 | 470426 | 101.3 | 8.2574414 | 0.009760465 |

| | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 4 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/Wb |
| 5 | Comp-2 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1305.906771 | 134156.0935 | 0.000765751 |
| 6 | Comp-4 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1573.885638 | 293347.7955 | 0.00063537 |
| 7 | Comp-6 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1406.562248 | 233858.7082 | 0.000710953 |
| 8 | Comp-8 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1322.900553 | 203009.0739 | 0.000755915 |
| 9 | Comp-10 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1470.615734 | 235814.727 | 0.000679987 |
| 10 | Comp-12 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1347.737619 | 192151.9386 | 0.000741984 |
| 11 | Comp-14 | 863.838 | 3.81 | 0.00192 | 2509.850852 | 1546.434145 | 222222.1327 | 0.000646649 |
| 12 | | | | | | | | |
| 13 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 14 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | Wb/6μU | (b/h)^2 | 6μU/Wb |
| 15 | Comp-2 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1402.1162 | 314138.473 | 0.000713208 |
| 16 | Comp-6 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1024.897121 | 196040.3126 | 0.000975708 |
| 17 | Comp-8 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1349.922365 | 251360.6564 | 0.000740783 |
| 18 | Comp-10 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1161.312825 | 124725.2224 | 0.000861094 |
| 19 | Comp-12 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1402.1162 | 186228.2422 | 0.000713208 |
| 20 | Comp-14 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1264.514271 | 280007.8306 | 0.000790817 |
| 21 | Comp-16 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1281.121401 | 188461.7645 | 0.000780566 |
| 22 | Comp-18 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1590.725739 | 278715.6182 | 0.000628644 |
| 23 | Comp-20 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1211.134213 | 118991.9331 | 0.000825672 |
| 24 | Comp-22 | 857.349 | 5.715 | 0.00192 | 2277.549157 | 1292.983636 | 187638.166 | 0.000773405 |
| 25 | | | | | | | | |
| 26 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 27 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | Wb/6μU | (b/h)^2 | 6μU/Wb |
| 28 | Comp-6 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 907.3982451 | 106485.424 | 0.001102052 |
| 29 | Comp-8 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 997.8226357 | 212503.7902 | 0.001002182 |
| 30 | Comp-12 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 870.597621 | 83776.82325 | 0.001148636 |
| 31 | Comp-14 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 941.04453 | 102459.1606 | 0.001062649 |
| 32 | Comp-16 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 1025.160242 | 92590.48186 | 0.000975457 |
| 33 | Comp-18 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 993.6168501 | 153618.9914 | 0.001006424 |
| 34 | Comp-20 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 918.9641555 | 60402.57453 | 0.001088182 |
| 35 | Comp-24 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 1108.224508 | 223850.5543 | 0.000902344 |
| 36 | Comp-28 | 851.427 | 7.62 | 0.00192 | 2018.777092 | 1067.218098 | 116908.6031 | 0.000937016 |
| 37 | | | | | | | | |
| 38 | #254 Havoline SAE30 Motored 2500 rpm | | | | | | | |
| 39 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | Wb/6μU | (b/h)^2 | 6μU/Wb |
| 40 | Comp-2 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1110.143267 | 223333.7109 | 0.000900785 |
| 41 | Comp-4 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1218.777976 | 156198.8916 | 0.000820494 |
| 42 | Comp-6 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1102.900953 | 159673.3303 | 0.0009067 |
| 43 | Comp-8 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1060.481686 | 190914.7824 | 0.000942968 |
| 44 | Comp-10 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1243.608767 | 255979.0238 | 0.000804111 |
| 45 | Comp-12 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 958.0546741 | 109150.6346 | 0.001043782 |
| 46 | Comp-16 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1078.070162 | 183332.1572 | 0.000927583 |
| 47 | Comp-18 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1081.174011 | 166659.0489 | 0.00092492 |
| 48 | Comp-20 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1139.112523 | 197258.3352 | 0.000877876 |
| 49 | Comp-22 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1059.447069 | 121880.0241 | 0.000943889 |
| 50 | Comp-26 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1041.858593 | 146185.8078 | 0.000959823 |
| 51 | Comp-30 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 958.0546741 | 103517.3787 | 0.001043782 |
| 52 | Comp-32 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 1124.627895 | 160587.0794 | 0.000889183 |
| 53 | Comp-34 | 846.009 | 9.525 | 0.00192 | 1986.463255 | 951.8469764 | 101308.2705 | 0.001050589 |
| 54 | | | | | | | | |
| 55 | #301 MOBIL 1 MOTORED 1000 RPM | | | | | | | |
| 56 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 57 | Comp-2 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1254.002823 | 106892.6698 | 0.000797446 |
| 58 | Comp-4 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1050.507038 | 65257.80804 | 0.000951921 |
| 59 | Comp-6 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1213.516751 | 124039.8008 | 0.000824051 |
| 60 | Comp-8 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1072.88092 | 106534.5061 | 0.00093207 |
| 61 | Comp-10 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1307.273971 | 119602.2325 | 0.000764951 |
| 62 | Comp-12 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1233.759787 | 102978.0045 | 0.000810531 |
| 63 | Comp-14 | 863.838 | 3.81 | 0.00192 | 2045.612082 | 1304.077703 | 111476.5507 | 0.000766825 |
| 64 | | | | | | | | |
| 65 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 66 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 67 | Comp-2 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 854.8918989 | 53407.33488 | 0.001169739 |
| 68 | Comp-4 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1262.162024 | 180987.1034 | 0.000792291 |
| 69 | Comp-6 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1080.110401 | 99974.99772 | 0.000925831 |
| 70 | Comp-8 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1087.617685 | 98546.38624 | 0.000919441 |
| 71 | Comp-10 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1077.29517 | 101857.4733 | 0.000928251 |
| 72 | Comp-12 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1080.110401 | 128423.4635 | 0.000925831 |
| 73 | Comp-14 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1184.273959 | 125474.324 | 0.000844399 |

| | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|
| 74 | Comp-16 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1052.896499 | 107362.3869 | 0.000949761 |
| 75 | Comp-18 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 929.9647331 | 57753.69688 | 0.00107531 |
| 76 | Comp-20 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1080.110401 | 127015.5794 | 0.000925831 |
| 77 | Comp-22 | 857.349 | 5.715 | 0.00192 | 1801.74802 | 1139.230258 | 121065.9954 | 0.000877786 |
| 78 | | | | | | | | |
| 79 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 80 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 81 | Comp-2 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 937.7904625 | 149371.8042 | 0.001066336 |
| 82 | Comp-4 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 967.8322349 | 105570.4909 | 0.001033237 |
| 83 | Comp-6 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 970.2680543 | 100388.7627 | 0.001030643 |
| 84 | Comp-8 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 1060.393371 | 176641.6137 | 0.000943046 |
| 85 | Comp-10 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 875.2710984 | 79829.03388 | 0.001142503 |
| 86 | Comp-12 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 907.7486901 | 90633.99982 | 0.001101626 |
| 87 | Comp-14 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 967.8322349 | 109149.6386 | 0.001033237 |
| 88 | Comp-16 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 937.7904625 | 135460.3618 | 0.001066336 |
| 89 | Comp-18 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 936.9785227 | 136097.0005 | 0.00106726 |
| 90 | Comp-20 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 1000.309827 | 122409.4437 | 0.00099969 |
| 91 | Comp-22 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 873.6472188 | 99322.19884 | 0.001144627 |
| 92 | Comp-26 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 967.8322349 | 114821.2319 | 0.001033237 |
| 93 | Comp-28 | 851.427 | 7.62 | 0.00192 | 1558.924405 | 1027.91578 | 167162.6899 | 0.000972842 |
| 94 | | | | | | | | |
| 95 | #304 Mobil 1 Motored 2500 rpm | | | | | | | |
| 96 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6μU/bΔP |
| 97 | Comp-1 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 54.55881949 | 111678.5032 | 0.018328842 |
| 98 | Comp-3 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 57.64983175 | 147155.5702 | 0.017346104 |
| 99 | Comp-5 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 53.57754576 | 103424.139 | 0.018664535 |
| 100 | Comp-7 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 47.9352218 | 71450.8392 | 0.020861487 |
| 101 | Comp-11 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 51.02623406 | 108454.027 | 0.019597762 |
| 102 | Comp-13 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 52.35095359 | 93363.56472 | 0.019101849 |
| 103 | Comp-17 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 57.55170437 | 137271.6003 | 0.01737568 |
| 104 | Comp-19 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 59.90676133 | 131794.2912 | 0.016692607 |
| 105 | Comp-21 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 53.23409995 | 121917.5273 | 0.018784952 |
| 106 | Comp-23 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 59.71050658 | 131255.2783 | 0.016747471 |
| 107 | Comp-25 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 52.54720834 | 82725.02125 | 0.019030507 |
| 108 | Comp-27 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 52.54720834 | 102172.9472 | 0.019030507 |
| 109 | Comp-29 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 50.33934244 | 72257.24046 | 0.019865178 |
| 110 | Comp-31 | 846.009 | 9.525 | 0.00192 | 1503.534377 | 53.47941839 | 124820.0498 | 0.018698782 |
| 111 | | | | | | | | |
| 112 | #352 PENNZOIL 15W-40 MOTORED 1500 RPM | | | | | | | |
| 113 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6μU | (b/h)^2 | 6Uμ/ΔPb |
| 114 | Comp-2 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 1127.150527 | 140130.2445 | 0.000586379 |
| 115 | Comp-4 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 1001.91158 | 91218.80403 | 0.000586379 |
| 116 | Comp-6 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 965.4945809 | 55213.37562 | 0.000586379 |
| 117 | Comp-8 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 966.3828004 | 80719.99173 | 0.000586379 |
| 118 | Comp-10 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 991.252946 | 77102.05527 | 0.000586379 |
| 119 | Comp-12 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 881.1137297 | 81819.88894 | 0.000586379 |
| 120 | Comp-16 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 1042.769676 | 100882.6034 | 0.000586379 |
| 121 | Comp-18 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 940.6244353 | 82086.55084 | 0.000586379 |
| 122 | Comp-22 | 863.838 | 5.715 | 0.00192 | 1705.381412 | 991.252946 | 122802.6771 | 0.000586379 |
| 123 | | | | | | | | |
| 124 | #353 PENNZOIL 15W40 MOTORED 2000 RPM | | | | | | | |
| 125 | Stroke/rev | rho (kg/m3) | U (m/s) | b (m) | WB/6μU | ΔPb/6μU | (b/h)^2 | 6Uμ/Wb |
| 126 | Comp-6 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 808.2427255 | 77532.23912 | 0.000650846 |
| 127 | Comp-8 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 804.2415239 | 92800.81938 | 0.000650846 |
| 128 | Comp-10 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 829.8492142 | 140893.6236 | 0.000650846 |
| 129 | Comp-12 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 805.8420045 | 113194.3067 | 0.000650846 |
| 130 | Comp-14 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 919.4761303 | 88325.06394 | 0.000650846 |
| 131 | Comp-16 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 859.4581061 | 89532.13801 | 0.000650846 |
| 132 | Comp-18 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 919.4761303 | 107079.8685 | 0.000650846 |
| 133 | Comp-20 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 873.8624319 | 87967.16598 | 0.000650846 |
| 134 | Comp-22 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 897.0694013 | 177648.0965 | 0.000650846 |
| 135 | Comp-24 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 860.2583464 | 103215.2569 | 0.000650846 |
| 136 | Comp-26 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 860.2583464 | 81746.69544 | 0.000650846 |
| 137 | Comp-28 | 857.349 | 7.62 | 0.00192 | 1536.461419 | 919.4761303 | 109470.9033 | 0.000650846 |
| 138 | | | | | | | | |
| 139 | #354 PENNZOIL 15W40 MOTORED 2500 RPM | | | | | | | |
| 140 | Stroke/rev | rho (kg/m3) | U (m/s) | B (m) | WB/6μU | ΔPb/6μU | (b/h)^2 | 6Uμ/Wb |
| 141 | Comp-2 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 916.242592 | 110797.7544 | 0.000548549 |
| 142 | Comp-4 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 1067.208988 | 125804.9112 | 0.000548549 |
| 143 | Comp-8 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 1008.341588 | 84172.03734 | 0.000548549 |
| 144 | Comp-10 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 939.0299725 | 78143.67963 | 0.000548549 |
| 145 | Comp-12 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 966.564724 | 108479.961 | 0.000548549 |
| 146 | Comp-18 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 965.6152498 | 85654.83386 | 0.000548549 |

| | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|
| 147 | Comp-20 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 1034.926866 | 93554.83392 | 0.000548549 |
| 148 | Comp-26 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 919.0910145 | 111081.3715 | 0.000548549 |
| 149 | Comp-32 | 846.009 | 9.525 | 0.00192 | 1822.990442 | 1182.095365 | 165730.7881 | 0.000548549 |
| 150 | | | | | | | | |
| 151 | **#401 Pennzoil SAE30 Motored 1000 rpm** | | | | | | | |
| 152 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6Uμ | (b/h)^2 | 6μU/Wb |
| 153 | Comp-2 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1416.34458 | 70862.44 | 0.000400459 |
| 154 | Comp-4 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1515.189565 | 105660.5361 | 0.000400459 |
| 155 | Comp-6 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1386.430967 | 72664.32871 | 0.000400459 |
| 156 | Comp-8 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1316.199004 | 66295.77626 | 0.000400459 |
| 157 | Comp-10 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1210.85106 | 56107.92361 | 0.000400459 |
| 158 | Comp-12 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1539.900811 | 74831.78783 | 0.000400459 |
| 159 | Comp-14 | 863.838 | 3.81 | 0.00192 | 2497.13645 | 1415.043988 | 71442.27059 | 0.000400459 |
| 160 | | | | | | | | |
| 161 | **#402 Pennzoil SAE30 Motored 1500 rpm** | | | | | | | |
| 162 | Stroke/Rev | rho )kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6Uμ | (b/h)^2 | 6μU/Wb |
| 163 | Comp-1 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1337.473569 | 91342.9275 | 0.000447049 |
| 164 | Comp-3 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1329.318243 | 96828.60502 | 0.000447049 |
| 165 | Comp-5 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1502.910196 | 118089.0809 | 0.000447049 |
| 166 | Comp-7 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1269.900863 | 112493.6906 | 0.000447049 |
| 167 | Comp-9 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1504.075242 | 129751.8156 | 0.000447049 |
| 168 | Comp-11 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1458.638422 | 91908.29418 | 0.000447049 |
| 169 | Comp-13 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1336.308523 | 124278.8363 | 0.000447049 |
| 170 | Comp-15 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1395.725903 | 108443.7963 | 0.000447049 |
| 171 | Comp-17 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1413.201602 | 166088.8483 | 0.000447049 |
| 172 | Comp-19 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1624.075049 | 172621.8882 | 0.000447049 |
| 173 | Comp-21 | 857.349 | 5.715 | 0.00192 | 2236.889593 | 1302.522169 | 73555.21471 | 0.000447049 |
| 174 | | | | | | | | |
| 175 | **#403 Pennzoil SAE30 Motored 2000 rpm** | | | | | | | |
| 176 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6Uμ | (b/h)^2 | 6μU/Wb |
| 177 | Comp-1 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1214.030971 | 98126.67589 | 0.000509666 |
| 178 | Comp-3 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1163.957303 | 120614.4617 | 0.000509666 |
| 179 | Comp-5 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1211.987147 | 80833.32257 | 0.000509666 |
| 180 | Comp-7 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1206.87759 | 102332.0823 | 0.000509666 |
| 181 | Comp-9 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1251.8417 | 90525.09382 | 0.000509666 |
| 182 | Comp-11 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1251.8417 | 77611.11978 | 0.000509666 |
| 183 | Comp-13 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1244.688318 | 88931.1226 | 0.000509666 |
| 184 | Comp-15 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1101.620696 | 90961.33265 | 0.000509666 |
| 185 | Comp-17 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1088.335845 | 72390.27405 | 0.000509666 |
| 186 | Comp-19 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1138.409513 | 72313.17211 | 0.000509666 |
| 187 | Comp-21 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1213.009059 | 80268.4502 | 0.000509666 |
| 188 | Comp-23 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1101.620696 | 60368.58831 | 0.000509666 |
| 189 | Comp-25 | 851.427 | 7.62 | 0.00192 | 1962.070256 | 1099.576872 | 81898.85306 | 0.000509666 |
| 190 | | | | | | | | |
| 191 | **#404 Pennzoil SAE30 Motored 2500 rpm** | | | | | | | |
| 192 | Stroke/Rev | rho (kg/m3) | U (m/s) | B (m) | ΔPB/6μU | ΔPb/6Uμ | (b/h)^2 | 6μU/Wb |
| 193 | Comp-2 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 941.1714823 | 80647.66327 | 0.000617581 |
| 194 | Comp-4 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 915.02783 | 49282.51916 | 0.000617581 |
| 195 | Comp-6 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 935.2680769 | 86926.93197 | 0.000617581 |
| 196 | Comp-10 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 794.429692 | 49160.04764 | 0.000617581 |
| 197 | Comp-12 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 897.3176139 | 51946.77218 | 0.000617581 |
| 198 | Comp-20 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 797.8030665 | 46897.50008 | 0.000617581 |
| 199 | Comp-22 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 835.7535295 | 56480.01301 | 0.000617581 |
| 200 | Comp-26 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 814.669939 | 53393.015 | 0.000617581 |
| 201 | Comp-30 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 815.5132826 | 49052.00886 | 0.000617581 |
| 202 | Comp-32 | 846.009 | 9.525 | 0.00192 | 1619.219754 | 897.3176139 | 73990.27806 | 0.000617581 |

| | Y | Z | AA | AB | AC | AD | AE | AF |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | #251 Havoline SAE30 Motored 1000 rpm | | | | | | | |
| 4 | Stroke/Rev | ∂/b | (∂+ho)/ho | \PBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 5 | Comp-2 | 0.002951913 | 2.081206616 | 0.018708437 | 1.092298402 | 0.524839001 | 0.006252002 | 0.003472497 |
| 6 | Comp-4 | 0.004328782 | 3.34453739 | 0.008555888 | 1.43066167 | 0.427760704 | 0.004153065 | 0.002306702 |
| 7 | Comp-6 | 0.004588859 | 3.219123607 | 0.010732339 | 1.378284794 | 0.428155288 | 0.00416073 | 0.00231096 |
| 8 | Comp-8 | 0.003591453 | 2.618184092 | 0.012363245 | 1.131589167 | 0.43220382 | 0.004239788 | 0.00235487 |
| 9 | Comp-10 | 0.003291785 | 2.598515896 | 0.010643317 | 1.158399209 | 0.44579262 | 0.004510583 | 0.002505275 |
| 10 | Comp-12 | 0.00419057 | 2.836942112 | 0.013061803 | 1.283963175 | 0.452587019 | 0.004649124 | 0.002582224 |
| 11 | Comp-14 | 0.003478136 | 2.639608682 | 0.011294333 | 1.274666144 | 0.482899664 | 0.005292742 | 0.002939704 |
| 12 | | | | | | | | |
| 13 | #252 Havoline SAE30 Motored 1500 rpm | | | | | | | |
| 14 | Stroke/Rev | ∂/b | (∂+ho)/ho | \PBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 15 | Comp-2 | 0.001914556 | 2.073071646 | 0.007250144 | 1.704762534 | 0.822336525 | 0.003391809 | 0.001559783 |
| 16 | Comp-6 | 0.002381171 | 2.0542976 | 0.011617759 | 1.56313712 | 0.760910746 | 0.00290402 | 0.001335465 |
| 17 | Comp-8 | 0.002952746 | 2.48038512 | 0.009060882 | 2.195358229 | 0.885087647 | 0.003929206 | 0.001806914 |
| 18 | Comp-10 | 0.002311864 | 1.816468395 | 0.018260534 | 1.963478103 | 1.080931608 | 0.005860419 | 0.002695016 |
| 19 | Comp-12 | 0.001914509 | 1.826190403 | 0.012229881 | 1.950443745 | 1.068039643 | 0.005721461 | 0.002631114 |
| 20 | Comp-14 | 0.002187454 | 2.157507983 | 0.008133877 | 1.694795084 | 0.785533633 | 0.003095008 | 0.001423294 |
| 21 | Comp-16 | 0.001777856 | 1.771806018 | 0.01208494 | 1.718782684 | 0.970073849 | 0.004719998 | 0.002170574 |
| 22 | Comp-18 | 0.001738661 | 1.917900627 | 0.008171588 | 1.899620704 | 0.990468785 | 0.004920552 | 0.002262802 |
| 23 | Comp-20 | 0.002149248 | 1.741387492 | 0.019140366 | 2.009810315 | 1.154143075 | 0.006681154 | 0.003072446 |
| 24 | Comp-22 | 0.002264947 | 1.981112066 | 0.012137985 | 1.9438718 | 0.981202343 | 0.004828913 | 0.00222066 |
| 25 | | | | | | | | |
| 26 | #253 Havoline SAE30 Motored 2000 rpm | | | | | | | |
| 27 | Stroke/Rev | ∂/b | (∂+ho)/ho | \PBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 28 | Comp-6 | 0.001033142 | 1.337135817 | 0.018958248 | 2.343897372 | 1.752923931 | 0.005134168 | 0.002218355 |
| 29 | Comp-8 | 0.001517624 | 1.699596114 | 0.009499958 | 2.319134614 | 1.364521015 | 0.003111031 | 0.001344205 |
| 30 | Comp-12 | 0.001407887 | 1.407501964 | 0.024097083 | 2.668792194 | 1.896119694 | 0.006007246 | 0.002595592 |
| 31 | Comp-14 | 0.000612956 | 1.196202532 | 0.019703237 | 2.216918421 | 1.853296881 | 0.00573897 | 0.002479676 |
| 32 | Comp-16 | 0.001195621 | 1.363811695 | 0.02180329 | 2.896497848 | 2.123825349 | 0.007536706 | 0.003256436 |
| 33 | Comp-18 | 0.001378812 | 1.54041522 | 0.013141455 | 2.461753201 | 1.598110152 | 0.004267341 | 0.001843819 |
| 34 | Comp-20 | 0.000678785 | 1.166824645 | 0.033422037 | 2.750341725 | 2.357116588 | 0.009283379 | 0.004011133 |
| 35 | Comp-24 | 0.001041058 | 1.492554251 | 0.009018415 | 2.203885391 | 1.476586455 | 0.003643021 | 0.001574065 |
| 36 | Comp-28 | 0.000878397 | 1.300340651 | 0.017267994 | 2.558569996 | 1.967615174 | 0.006468808 | 0.002795022 |
| 37 | | | | | | | | |
| 36 | #254 Havoline SAE30 Motored 2500 rpm | | | | | | | |
| 39 | Stroke/Rev | ∂/b | (∂+ho)/ho | \PBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 40 | Comp-2 | 0.002300858 | 2.087343808 | 0.008894597 | 4.800215794 | 2.29967664 | 0.003725627 | 0.001608022 |
| 41 | Comp-4 | 0.001630072 | 1.644237112 | 0.012717525 | 4.963807786 | 3.018912387 | 0.006420471 | 0.002771147 |
| 42 | Comp-6 | 0.00231594 | 1.925429868 | 0.012440796 | 5.20250984 | 2.701999136 | 0.005143234 | 0.002219877 |
| 43 | Comp-8 | 0.001813565 | 1.792415552 | 0.010404974 | 4.258797429 | 2.376010086 | 0.003977062 | 0.001716545 |
| 44 | Comp-10 | 0.001083938 | 1.548411507 | 0.007760258 | 3.725914298 | 2.406281717 | 0.004079048 | 0.001760563 |
| 45 | Comp-12 | 0.001333178 | 1.440454596 | 0.018199283 | 4.089230774 | 2.838847393 | 0.005677406 | 0.002450432 |
| 46 | Comp-16 | 0.001901432 | 1.814141927 | 0.010835324 | 4.471609272 | 2.464861875 | 0.004280071 | 0.001847327 |
| 47 | Comp-18 | 0.001246761 | 1.508976385 | 0.011919324 | 3.912266915 | 2.592662784 | 0.004735414 | 0.002043857 |
| 48 | Comp-20 | 0.000934263 | 1.414941474 | 0.010070364 | 3.552649041 | 2.510809887 | 0.00444113 | 0.001916841 |
| 49 | Comp-22 | 0.00154028 | 1.537732235 | 0.016298514 | 4.568341928 | 2.970830567 | 0.006217583 | 0.002683578 |
| 50 | Comp-26 | 0.001089508 | 1.416565346 | 0.013588619 | 3.778832751 | 2.667602141 | 0.005013118 | 0.002163718 |
| 51 | Comp-30 | 0.002222013 | 1.714913137 | 0.01918966 | 4.999086755 | 2.915067036 | 0.005986361 | 0.00258378 |
| 52 | Comp-32 | 0.001088037 | 1.436012675 | 0.012370007 | 3.945269821 | 2.747378132 | 0.005317441 | 0.002295067 |
| 53 | Comp-34 | 0.001192599 | 1.379591837 | 0.019608106 | 4.038872891 | 2.92758538 | 0.006037887 | 0.002606019 |
| 54 | | | | | | | | |
| 55 | #301 MOBIL 1 Motored 1000 rpm | | | | | | | |
| 56 | Stroke/rev | ∂/b | (∂+ho)/ho | \PBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 57 | Comp-2 | 0.003866263 | 2.264053254 | 0.019137066 | 1.278292729 | 0.564603649 | 0.008877259 | 0.004930622 |
| 58 | Comp-4 | 0.005274434 | 2.347386172 | 0.031346626 | 1.420974864 | 0.605343458 | 0.010204583 | 0.005667846 |
| 59 | Comp-6 | 0.004438909 | 2.563351935 | 0.016491578 | 1.300147456 | 0.50720599 | 0.007164078 | 0.003979084 |
| 60 | Comp-8 | 0.004303603 | 2.404679708 | 0.019201404 | 1.163543811 | 0.483866441 | 0.006519924 | 0.003621307 |
| 61 | Comp-10 | 0.003414302 | 2.180787191 | 0.017103461 | 1.213470959 | 0.556437127 | 0.008622312 | 0.004789019 |
| 62 | Comp-12 | 0.00386736 | 2.241042879 | 0.019864554 | 1.268316579 | 0.565949269 | 0.008919624 | 0.004954152 |
| 63 | Comp-14 | 0.003245494 | 2.083609071 | 0.018350156 | 1.197973127 | 0.574951004 | 0.009205624 | 0.005113003 |
| 64 | | | | | | | | |
| 65 | #302 Mobil 1 Motored 1500 rpm | | | | | | | |
| 66 | Stroke/rev | ∂/b | (∂+ho)/ho | \PBh^2/6μUb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 67 | Comp-2 | 0.003171299 | 1.732888022 | 0.033735966 | 2.1072079 | 1.216009271 | 0.009375181 | 0.004311341 |
| 68 | Comp-4 | 0.002738831 | 2.16516938 | 0.009955118 | 2.1115886 | 0.975253308 | 0.006030326 | 0.002773151 |
| 69 | Comp-6 | 0.003074764 | 1.972204161 | 0.018021986 | 2.214626311 | 1.122919399 | 0.007994717 | 0.00367651 |
| 70 | Comp-8 | 0.0020562 | 1.645484414 | 0.018283248 | 1.874026897 | 1.1388907 | 0.008223752 | 0.003781836 |
| 71 | Comp-10 | 0.002453972 | 1.783188024 | 0.017688913 | 1.978616106 | 1.10959477 | 0.007806111 | 0.003589777 |
| 72 | Comp-12 | 0.002259162 | 1.809598379 | 0.014029742 | 1.792892685 | 0.990768286 | 0.006223721 | 0.002862087 |
| 73 | Comp-14 | 0.002346702 | 1.831257266 | 0.014359496 | 2.01256653 | 1.099008079 | 0.007657865 | 0.003521603 |

| | Y | Z | AA | AB | AC | AD | AE | AF |
|---|---|---|---|---|---|---|---|---|
| 74 | Comp-16 | 0.002446234 | 1.80153793 | 0.01678193 | 1.902957769 | 1.056296255 | 0.007074201 | 0.003253195 |
| 75 | Comp-18 | 0.001894864 | 1.455373798 | 0.031197103 | 1.851302016 | 1.272045723 | 0.010259149 | 0.004717849 |
| 76 | Comp-20 | 0.002823889 | 2.006412605 | 0.014185252 | 1.998876843 | 0.996244161 | 0.006292707 | 0.002893811 |
| 77 | Comp-22 | 0.002915444 | 2.014415331 | 0.014882362 | 2.168081375 | 1.076283198 | 0.007344446 | 0.003377472 |
| 78 | | | | | | | | |
| 79 | #303 Mobil 1 Motored 2000 rpm | | | | | | | |
| 80 | Stroke/rev | ∂/b | (∂+ho)/ho | ∆PBh^2/6µUb^ | rhoUhGamma/µ | rhoUh/µ | P1 | P2 |
| 81 | Comp-2 | 0.002501601 | 1.966834967 | 0.010436537 | 3.008497369 | 1.529613526 | 0.005063922 | 0.002187433 |
| 82 | Comp-4 | 0.00193921 | 1.630080645 | 0.014766668 | 3.060892803 | 1.877755442 | 0.007631355 | 0.003296472 |
| 83 | Comp-6 | 0.00217598 | 1.689441481 | 0.015528874 | 3.261388626 | 1.93045374 | 0.008065706 | 0.003484096 |
| 84 | Comp-8 | 0.001714436 | 1.720556032 | 0.008825352 | 2.736525694 | 1.590489146 | 0.005475011 | 0.002365009 |
| 85 | Comp-10 | 0.00214401 | 1.605769231 | 0.019528289 | 3.135851589 | 1.95286566 | 0.008254073 | 0.003565464 |
| 86 | Comp-12 | 0.002002996 | 1.603011472 | 0.017200216 | 3.046961069 | 1.90077309 | 0.007819593 | 0.003377784 |
| 87 | Comp-14 | 0.002545074 | 1.840836408 | 0.014282451 | 3.39949451 | 1.846711905 | 0.007381113 | 0.003188377 |
| 88 | Comp-16 | 0.001688312 | 1.621382106 | 0.011508344 | 2.604325653 | 1.606238063 | 0.005583974 | 0.002412077 |
| 89 | Comp-18 | 0.002378401 | 1.877423626 | 0.01145451 | 3.005923027 | 1.601089378 | 0.005548234 | 0.002396638 |
| 90 | Comp-20 | 0.001934844 | 1.676945051 | 0.012735328 | 3.022429103 | 1.802342361 | 0.007030693 | 0.003037008 |
| 91 | Comp-22 | 0.001812268 | 1.571143847 | 0.015695629 | 2.745611607 | 1.747524017 | 0.006609519 | 0.002855076 |
| 92 | Comp-26 | 0.001946904 | 1.659714045 | 0.01357697 | 2.988356927 | 1.800525178 | 0.007016523 | 0.003030887 |
| 93 | Comp-28 | 0.001882881 | 1.769826104 | 0.009325792 | 2.804972908 | 1.584886166 | 0.005436504 | 0.002348375 |
| 94 | | | | | | | | |
| 95 | #304 Mobil 1 Motored 2500 rpm | | | | | | | |
| 96 | Stroke/rev | ∂/b | (∂+ho)/ho | ∆PBh^2/6µUb^ | rhoUhGamma/µ | rhoUh/µ | P1 | P2 |
| 97 | Comp-1 | 0.000974309 | 1.325597937 | 0.01346306 | 3.381495654 | 2.550921029 | 0.006056574 | 0.002614085 |
| 98 | Comp-3 | 0.001659826 | 1.636723655 | 0.010217312 | 3.843278815 | 2.348153767 | 0.005131993 | 0.002215026 |
| 99 | Comp-5 | 0.001190476 | 1.382852662 | 0.014537558 | 3.59968593 | 2.603087103 | 0.00630682 | 0.002722094 |
| 100 | Comp-7 | 0.001626462 | 1.434757973 | 0.021042921 | 4.020189849 | 2.801998612 | 0.0073075 | 0.003153999 |
| 101 | Comp-11 | 0.001458523 | 1.480326026 | 0.013863334 | 3.583809298 | 2.420959461 | 0.005455167 | 0.002354511 |
| 102 | Comp-13 | 0.000947744 | 1.289587393 | 0.016104081 | 3.452260068 | 2.677026843 | 0.006670194 | 0.00287893 |
| 103 | Comp-17 | 0.000985184 | 1.365012616 | 0.010952989 | 3.31299933 | 2.427083305 | 0.0054828 | 0.002366438 |
| 104 | Comp-19 | 0.001184183 | 1.429899719 | 0.01140819 | 3.686803273 | 2.57836492 | 0.006187594 | 0.002670635 |
| 105 | Comp-21 | 0.001531099 | 1.534609159 | 0.012332389 | 3.655707757 | 2.382175119 | 0.005281781 | 0.002279676 |
| 106 | Comp-23 | 0.000830931 | 1.301039281 | 0.011455039 | 3.350422818 | 2.575189594 | 0.006172363 | 0.002664061 |
| 107 | Comp-25 | 0.000809397 | 1.232798347 | 0.018175086 | 3.519168728 | 2.854618304 | 0.007584538 | 0.003273571 |
| 108 | Comp-27 | 0.001079011 | 1.344900662 | 0.014715582 | 3.454528158 | 2.568612132 | 0.006140872 | 0.002650469 |
| 109 | Comp-29 | 0.000703888 | 1.189210139 | 0.020808079 | 3.479703959 | 2.926063145 | 0.007968937 | 0.003439482 |
| 110 | Comp-31 | 0.001325118 | 1.468162639 | 0.012045616 | 3.47244607 | 2.365164443 | 0.005206618 | 0.002247234 |
| 111 | | | | | | | | |
| 112 | #352 Pennzoil 15W-40 Motored 1500 rpm | | | | | | | |
| 113 | Stroke/rev | ∂/b | (∂+ho)/ho | ∆PBh^2/6µUb^ | rhoUhGamma/µ | rhoUh/µ | P1 | P2 |
| 114 | Comp-2 | 0.002050587 | 1.767616053 | 0.012169974 | 1.762806781 | 0.997279232 | 0.0065624 | 0.003017834 |
| 115 | Comp-4 | 0.001221403 | 1.368893738 | 0.018695503 | 1.504034307 | 1.098722469 | 0.007965355 | 0.003663008 |
| 116 | Comp-6 | 0.001267184 | 1.297756997 | 0.030887106 | 1.766126741 | 1.360907123 | 0.012220419 | 0.005619773 |
| 117 | Comp-8 | 0.00133661 | 1.379747872 | 0.021127126 | 1.554387041 | 1.126573248 | 0.00837429 | 0.003851064 |
| 118 | Comp-10 | 0.001440152 | 1.399890804 | 0.022118495 | 1.655184729 | 1.182367028 | 0.009224307 | 0.004241959 |
| 119 | Comp-12 | 0.001928911 | 1.551749073 | 0.020843116 | 1.583160032 | 1.020242292 | 0.006868087 | 0.00315841 |
| 120 | Comp-16 | 0.002085948 | 1.662539225 | 0.016904613 | 1.807810689 | 1.08737927 | 0.007801735 | 0.003587765 |
| 121 | Comp-18 | 0.002312467 | 1.662539225 | 0.020775406 | 1.807810689 | 1.08737927 | 0.007801735 | 0.003587765 |
| 122 | Comp-22 | 0.001303075 | 1.456639433 | 0.013887168 | 1.364688189 | 0.936874396 | 0.005791511 | 0.002663328 |
| 123 | | | | | | | | |
| 124 | #353 Pennzoil 15W40 Motored 2000 rpm | | | | | | | |
| 125 | Stroke/rev | ∂/b | (∂+ho)/ho | ∆PBh^2/6µUb^ | rhoUhGamma/µ | rhoUh/µ | P1 | P2 |
| 126 | Comp-6 | 0.001894534 | 1.527525711 | 0.019817065 | 2.81455419 | 1.842557654 | 0.007352731 | 0.003176117 |
| 127 | Comp-8 | 0.001446997 | 1.440801976 | 0.01655655 | 2.41454513 | 1.675834133 | 0.00608231 | 0.00262734 |
| 128 | Comp-10 | 0.002361526 | 1.886417792 | 0.010905117 | 2.647352951 | 1.403375733 | 0.004265348 | 0.001842477 |
| 129 | Comp-12 | 0.002355953 | 1.792645503 | 0.013573663 | 2.725539435 | 1.520400676 | 0.005006366 | 0.002162571 |
| 130 | Comp-14 | 0.001398517 | 1.415632855 | 0.017395531 | 2.780158506 | 1.963897981 | 0.008353036 | 0.003608213 |
| 131 | Comp-16 | 0.001425252 | 1.426462882 | 0.017161004 | 2.600855082 | 1.823289701 | 0.007199758 | 0.003110037 |
| 132 | Comp-18 | 0.000932527 | 1.305151326 | 0.014348742 | 2.327918965 | 1.783639122 | 0.00689002 | 0.002976242 |
| 133 | Comp-20 | 0.001541849 | 1.457300979 | 0.017466306 | 2.725539435 | 1.870265288 | 0.007575529 | 0.003272357 |
| 134 | Comp-22 | 0.001365412 | 1.575498273 | 0.008648904 | 2.128551392 | 1.351033783 | 0.00395311 | 0.001707602 |
| 135 | Comp-24 | 0.001139025 | 1.365935919 | 0.014885991 | 2.321708633 | 1.699720024 | 0.00625693 | 0.00270277 |
| 136 | Comp-26 | 0.001352774 | 1.386776722 | 0.018795395 | 2.648626865 | 1.909915867 | 0.007900144 | 0.003412579 |
| 137 | Comp-28 | 0.000999097 | 1.330565084 | 0.014035341 | 2.347186917 | 1.764052691 | 0.00673953 | 0.002911236 |
| 138 | | | | | | | | |
| 139 | #354 Pennzoil 15W40 Motored 2500 rpm | | | | | | | |
| 140 | Stroke/rev | ∂/b | (∂+ho)/ho | ∆PBh^2/6µUb^ | rhoUhGamma/µ | rhoUh/µ | P1 | P2 |
| 141 | Comp-2 | 0.001189566 | 1.395962414 | 0.016453316 | 3.761695241 | 2.69469665 | 0.00557419 | 0.002405883 |
| 142 | Comp-4 | 0.001113494 | 1.394945098 | 0.014490614 | 4.108872613 | 2.945544321 | 0.00666029 | 0.002874655 |
| 143 | Comp-8 | 0.000720826 | 1.209129057 | 0.02165791 | 4.113971735 | 3.402425664 | 0.008886675 | 0.003835588 |
| 144 | Comp-10 | 0.000619035 | 1.173046252 | 0.0233287 | 3.857558737 | 3.288496707 | 0.008301505 | 0.003583022 |
| 145 | Comp-12 | 0.000751766 | 1.247603882 | 0.016804859 | 3.584245791 | 2.872903684 | 0.006335839 | 0.002734619 |
| 146 | Comp-18 | 0.000677202 | 1.19819576 | 0.021282984 | 3.870088008 | 3.229929647 | 0.008008443 | 0.003456534 |

| | Y | Z | AA | AB | AC | AD | AE | AF |
|---|---|---|---|---|---|---|---|---|
| 147 | Comp-20 | 0.000561675 | 1.17179803 | 0.019485796 | 3.881451766 | 3.312389736 | 0.008422574 | 0.003635277 |
| 148 | Comp-26 | 0.000948859 | 1.316243929 | 0.016411307 | 3.553359679 | 2.699620945 | 0.005594581 | 0.002414684 |
| 149 | Comp-32 | 0.000922134 | 1.375401048 | 0.010999709 | 3.909715472 | 2.84260033 | 0.006202883 | 0.002677234 |
| 150 | | | | | | | | |
| 151 | #401 Pennzoil SAE30 Motored 1000 rpm | | | | | | | |
| 152 | Stroke/Rev | ∂/b | (∂+ho)/ho | \PBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 153 | Comp-2 | 0.001616622 | 1.430344828 | 0.035239211 | 1.120264959 | 0.783213207 | 0.0139937 | 0.007772404 |
| 154 | Comp-4 | 0.001642472 | 1.533893116 | 0.023633577 | 1.052506514 | 0.686166789 | 0.010740684 | 0.005965609 |
| 155 | Comp-6 | 0.001795009 | 1.483868411 | 0.034365369 | 1.123445825 | 0.7571061 | 0.013076335 | 0.00726288 |
| 156 | Comp-8 | 0.001966372 | 1.506300845 | 0.037666599 | 1.133468554 | 0.752484842 | 0.012917191 | 0.007174487 |
| 157 | Comp-10 | 0.0019728 | 1.46729941 | 0.04450595 | 1.104120565 | 0.752484842 | 0.012917191 | 0.007174487 |
| 158 | Comp-12 | 0.001875053 | 1.512928225 | 0.033369996 | 1.253681278 | 0.828645575 | 0.015664271 | 0.008700275 |
| 159 | Comp-14 | 0.001829015 | 1.488871775 | 0.034953207 | 1.160295857 | 0.779312145 | 0.013854646 | 0.007695171 |
| 160 | | | | | | | | |
| 161 | #402 Pennzoil SAE30 Motored 1500 rpm | | | | | | | |
| 162 | Stroke/Rev | ∂/b | (∂+ho)/ho | WBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 163 | Comp-1 | 0.002733389 | 1.826112074 | 0.024488919 | 2.65644795 | 1.454701487 | 0.010806951 | 0.004969765 |
| 164 | Comp-3 | 0.002884232 | 1.897495084 | 0.023101537 | 2.664611662 | 1.404278559 | 0.010070753 | 0.004631212 |
| 165 | Comp-5 | 0.002847561 | 1.978538622 | 0.018942391 | 2.84445344 | 1.437653735 | 0.01055514 | 0.004853966 |
| 166 | Comp-7 | 0.003440511 | 2.153950034 | 0.019884578 | 2.680819032 | 1.244605952 | 0.007910777 | 0.003637909 |
| 167 | Comp-9 | 0.003023342 | 2.089040497 | 0.017239756 | 2.867383867 | 1.372584147 | 0.009621291 | 0.004424519 |
| 168 | Comp-11 | 0.003056426 | 1.926597844 | 0.024338278 | 3.047105591 | 1.581599191 | 0.012774629 | 0.005874636 |
| 169 | Comp-13 | 0.004137002 | 2.458425667 | 0.017998958 | 3.063312961 | 1.246046607 | 0.007929102 | 0.003646336 |
| 170 | Comp-15 | 0.002683155 | 1.883584662 | 0.020627179 | 2.624273319 | 1.393233536 | 0.009912958 | 0.004558647 |
| 171 | Comp-17 | 0.003217831 | 2.311394778 | 0.01346803 | 2.634718069 | 1.139882332 | 0.006635528 | 0.003051463 |
| 172 | Comp-19 | 0.002360767 | 1.980846492 | 0.01295832 | 2.545277398 | 1.284944295 | 0.008431872 | 0.003877544 |
| 173 | Comp-21 | 0.00342248 | 1.928212928 | 0.030411027 | 3.044104226 | 1.57871788 | 0.012728126 | 0.005853252 |
| 174 | | | | | | | | |
| 175 | #403 Pennzoil SAE30 Motored 2000 rpm | | | | | | | |
| 176 | Stroke/Rev | ∂/b | (∂+ho)/ho | WBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 177 | Comp-1 | 0.002770125 | 1.867746735 | 0.019995279 | 4.563146642 | 2.443129229 | 0.010264244 | 0.004433786 |
| 178 | Comp-3 | 0.003157915 | 2.096731027 | 0.016267289 | 4.429863017 | 2.112747396 | 0.007675899 | 0.003315713 |
| 179 | Comp-5 | 0.002258322 | 1.642068084 | 0.024273037 | 4.412697702 | 2.687280597 | 0.012418242 | 0.005364236 |
| 180 | Comp-7 | 0.002851311 | 1.912116838 | 0.019173559 | 4.547596885 | 2.378304921 | 0.009726781 | 0.004201621 |
| 181 | Comp-9 | 0.002686456 | 1.80828457 | 0.021674324 | 4.74287759 | 2.622860178 | 0.01182999 | 0.005110132 |
| 182 | Comp-11 | 0.00224912 | 1.626577315 | 0.025280788 | 4.607574516 | 2.832680914 | 0.013798421 | 0.005960424 |
| 183 | Comp-13 | 0.002010593 | 1.59958554 | 0.022062808 | 4.208733367 | 2.631139918 | 0.011904796 | 0.005142446 |
| 184 | Comp-15 | 0.0021298 | 1.642343449 | 0.021570377 | 3.781619933 | 2.302575589 | 0.009117208 | 0.003938307 |
| 185 | Comp-17 | 0.002012157 | 1.541379583 | 0.027104059 | 3.930453314 | 2.549958074 | 0.011181502 | 0.004830009 |
| 186 | Comp-19 | 0.003022799 | 1.81286417 | 0.027132958 | 4.837993631 | 2.668701667 | 0.012247125 | 0.005290319 |
| 187 | Comp-21 | 0.002514439 | 1.71238309 | 0.024443854 | 4.621710658 | 2.6989934 | 0.01252673 | 0.005411099 |
| 188 | Comp-23 | 0.001624394 | 1.399114033 | 0.03250151 | 3.954484755 | 2.826420623 | 0.013737499 | 0.005934108 |
| 189 | Comp-25 | 0.003271725 | 1.936301484 | 0.023957237 | 4.68996803 | 2.422126961 | 0.01008853 | 0.004357884 |
| 190 | | | | | | | | |
| 191 | #404 Pennzoil SAE30 Motored 2500 rpm | | | | | | | |
| 192 | Stroke/Rev | ∂/b | (∂+ho)/ho | WBh^2/6Uμb^ | rhoUhGamma/μ | rhoUh/μ | P1 | P2 |
| 193 | Comp-2 | 0.001508691 | 1.428446075 | 0.020077702 | 4.634486281 | 3.244425086 | 0.009097375 | 0.003926529 |
| 194 | Comp-4 | 0.00063476 | 1.14091463 | 0.032855864 | 4.603688053 | 4.035085475 | 0.014071684 | 0.006073496 |
| 195 | Comp-6 | 0.000966162 | 1.284857071 | 0.018627366 | 3.990052772 | 3.105444848 | 0.008334666 | 0.003597335 |
| 196 | Comp-10 | 0.001056247 | 1.234191692 | 0.032937717 | 4.329092088 | 3.507633471 | 0.010633323 | 0.004589461 |
| 197 | Comp-12 | 0.001007024 | 1.229519205 | 0.031170748 | 4.738786162 | 3.854178237 | 0.012838201 | 0.005541111 |
| 198 | Comp-20 | 0.000728028 | 1.157660567 | 0.034526782 | 4.175100949 | 3.606498371 | 0.011241184 | 0.004851821 |
| 199 | Comp-22 | 0.001081204 | 1.256953842 | 0.028668898 | 4.327280428 | 3.442672503 | 0.010243114 | 0.004421042 |
| 200 | Comp-26 | 0.001188367 | 1.274595081 | 0.030326434 | 4.399229229 | 3.451471997 | 0.010295544 | 0.004443672 |
| 201 | Comp-30 | 0.000949516 | 1.210295807 | 0.033010264 | 4.362737211 | 3.60468671 | 0.011229893 | 0.004846947 |
| 202 | Comp-32 | 0.001222688 | 1.33258535 | 0.021884223 | 4.303470033 | 3.229414185 | 0.009013388 | 0.003890279 |

| | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | #251 Havoline SAE30 Motored 1000 rpm | | | | |
| 4 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 5 | Comp-2 | 0.063472 | 1.782921348 | 1.653690086 | 53.451819 |
| 6 | Comp-4 | 0.100092 | 2.811573034 | 2.264777983 | 116.8785768 |
| 7 | Comp-6 | 0.073239 | 2.057275281 | 1.924606431 | 93.17633677 |
| 8 | Comp-8 | 0.10986 | 3.085955056 | 2.373936968 | 80.88491543 |
| 9 | Comp-10 | 0.097656 | 2.743146067 | 2.184082256 | 93.95567343 |
| 10 | Comp-12 | 0.083009 | 2.331713483 | 1.991377148 | 76.55910648 |
| 11 | Comp-14 | 0.117191 | 3.291882022 | 2.311756344 | 88.5399754 |
| 12 | | | | | |
| 13 | #252 Havoline SAE30 Motored 1500 rpm | | | | |
| 14 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 15 | Comp-2 | 0.065923 | 1.851769663 | 1.878071846 | 137.9282955 |
| 16 | Comp-6 | 0.051271 | 1.440196629 | 1.738041429 | 86.07511807 |
| 17 | Comp-8 | 0.031734 | 0.891404494 | 1.392718362 | 110.3645362 |
| 18 | Comp-10 | 0.036624 | 1.028764045 | 1.37111647 | 54.76291128 |
| 19 | Comp-12 | 0.017091 | 0.48008427 | 1.175276128 | 81.76694742 |
| 20 | Comp-14 | 0.043943 | 1.234353933 | 1.612727805 | 122.9426069 |
| 21 | Comp-16 | 0.043945 | 1.234410112 | 1.49618924 | 82.74761665 |
| 22 | Comp-18 | 0.029293 | 0.822837079 | 1.323940858 | 122.3752372 |
| 23 | Comp-20 | 0.02685 | 0.754213483 | 1.254816361 | 52.24560478 |
| 24 | Comp-22 | 0.019529 | 0.548567416 | 1.218003818 | 82.38600051 |
| 25 | | | | | |
| 26 | #253 Havoline SAE30 Motored 2000 rpm | | | | |
| 27 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 28 | Comp-6 | 0.017091 | 0.48008427 | 1.181531402 | 52.74748974 |
| 29 | Comp-8 | 0.019532 | 0.548651685 | 1.266510206 | 105.2636227 |
| 30 | Comp-12 | 0.03906 | 1.097191011 | 1.383542812 | 41.49879824 |
| 31 | Comp-14 | -0.002442 | -0.068595506 | 0.975467149 | 50.75308266 |
| 32 | Comp-16 | 0.009766 | 0.274325843 | 1.085614097 | 45.86463865 |
| 33 | Comp-18 | 0.017086 | 0.47994382 | 1.199058648 | 76.09507359 |
| 34 | Comp-20 | 0.00403 | 0.113202247 | 1.031832543 | 29.92037841 |
| 35 | Comp-24 | 0.024413 | 0.685758427 | 1.307829069 | 110.8842354 |
| 36 | Comp-28 | 0.00732 | 0.205617978 | 1.069265708 | 57.91060515 |
| 37 | | | | | |
| 38 | #254 Havoline SAE30 Motored 2500 rpm | | | | |
| 39 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 40 | Comp-2 | 0.01709 | 0.48005618 | 1.211431399 | 112.4278088 |
| 41 | Comp-4 | 0.01221 | 0.342977528 | 1.115069268 | 78.63165412 |
| 42 | Comp-6 | 0.021969 | 0.617106742 | 1.231323246 | 80.38071174 |
| 43 | Comp-8 | 0.024417 | 0.685870787 | 1.292373642 | 96.10788517 |
| 44 | Comp-10 | 0.031743 | 0.891657303 | 1.375314802 | 128.8616958 |
| 45 | Comp-12 | 0.043949 | 1.234522472 | 1.440454596 | 54.94722056 |
| 46 | Comp-16 | 0.036354 | 1.021179775 | 1.419617711 | 92.29073667 |
| 47 | Comp-18 | 0.019532 | 0.548651685 | 1.214335879 | 83.89737313 |
| 48 | Comp-20 | 0.021969 | 0.617106742 | 1.248937689 | 99.30127561 |
| 49 | Comp-22 | 0.04883 | 1.371629213 | 1.467630722 | 61.35528749 |
| 50 | Comp-26 | 0.024418 | 0.685898876 | 1.260425332 | 73.59099517 |
| 51 | Comp-30 | 0.03418 | 0.96011236 | 1.333593598 | 52.11139872 |
| 52 | Comp-32 | 0.046384 | 1.302921348 | 1.480334693 | 80.84069966 |
| 53 | Comp-34 | 0.03418 | 0.96011236 | 1.332167153 | 50.9993176 |
| 54 | | | | | |
| 55 | #301 MOBIL 1 MOTORED 1000 RPM | | | | |
| 56 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 57 | Comp-2 | 0.08057 | 2.383727811 | 1.662146614 | 52.254614 |
| 58 | Comp-4 | 0.03417 | 1.010946746 | 1.261919362 | 31.90136028 |
| 59 | Comp-6 | 0.04882 | 1.444378698 | 1.446619705 | 60.63701024 |
| 60 | Comp-8 | 0.06347 | 1.877810651 | 1.608649789 | 52.07952523 |
| 61 | Comp-10 | 0.04394 | 1.3 | 1.366410941 | 58.46769949 |
| 62 | Comp-12 | 0.04883 | 1.444674556 | 1.400344347 | 50.34092502 |
| 63 | Comp-14 | 0.05859 | 1.733431953 | 1.472843193 | 54.49544986 |
| 64 | | | | | |
| 65 | #302 Mobil 1 Motored 1500 rpm | | | | |
| 66 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 67 | Comp-2 | 0.03906 | 1.155621302 | 1.293155209 | 29.64195564 |
| 68 | Comp-4 | 0.0708 | 2.094674556 | 1.66254913 | 100.4508408 |
| 69 | Comp-6 | 0.07079 | 2.094378698 | 1.575341352 | 55.48777999 |
| 70 | Comp-8 | 0.0537 | 1.588757396 | 1.430322943 | 54.69487696 |
| 71 | Comp-10 | 0.08789 | 2.600295858 | 1.722898503 | 56.5325851 |
| 72 | Comp-12 | 0.05615 | 1.661242604 | 1.517225497 | 71.27714982 |
| 73 | Comp-14 | 0.04883 | 1.444674556 | 1.405497426 | 69.64032853 |

| | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|
| 74 | Comp-16 | 0.07079 | 2.094378698 | 1.611629514 | 59.58790339 |
| 75 | Comp-18 | 0.04394 | 1.3 | 1.315253264 | 32.05425856 |
| 76 | Comp-20 | 0.0708 | 2.094674556 | 1.648589227 | 70.49575083 |
| 77 | Comp-22 | 0.03662 | 1.083431953 | 1.310523192 | 67.19363309 |
| 78 | | | | | |
| 79 | #303 Mobil 1 Motored 2000 rpm | | | | |
| 80 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 81 | Comp-2 | 0.04395 | 1.300295858 | 1.435105435 | 95.81722099 |
| 82 | Comp-4 | 0.04395 | 1.300295858 | 1.354435484 | 67.72008351 |
| 83 | Comp-6 | 0.04883 | 1.444674556 | 1.383040477 | 64.39617108 |
| 84 | Comp-8 | 0.05371 | 1.589053254 | 1.511377702 | 113.309929 |
| 85 | Comp-10 | 0.02685 | 0.794378698 | 1.208204094 | 51.20776454 |
| 86 | Comp-12 | 0.03174 | 0.939053254 | 1.252868069 | 58.1388036 |
| 87 | Comp-14 | 0.07568 | 2.239053254 | 1.620582206 | 70.01599194 |
| 88 | Comp-16 | 0.08789 | 2.600295858 | 1.828603752 | 86.89347692 |
| 89 | Comp-18 | 0.05127 | 1.516863905 | 1.484914405 | 87.30186022 |
| 90 | Comp-20 | 0.03906 | 1.155621302 | 1.328180138 | 78.5217316 |
| 91 | Comp-22 | 0.04394 | 1.3 | 1.380762565 | 63.71200457 |
| 92 | Comp-26 | 0.05403 | 1.59852071 | 1.454415475 | 73.65413713 |
| 93 | Comp-28 | 0.04883 | 1.444674556 | 1.46655838 | 107.2295035 |
| 94 | | | | | |
| 95 | #304 Mobil 1 Motored 2500 rpm | | | | |
| 96 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 97 | Comp-1 | 0.04639 | 1.372485207 | 1.412465546 | 74.27731946 |
| 98 | Comp-3 | 0.04638 | 1.372189349 | 1.447986091 | 97.87309981 |
| 99 | Comp-5 | 0.02441 | 0.722189349 | 1.212686242 | 68.7873457 |
| 100 | Comp-7 | 0.03418 | 1.011242604 | 1.276671523 | 47.52191921 |
| 101 | Comp-11 | 0.04639 | 1.372485207 | 1.434607457 | 72.13272181 |
| 102 | Comp-13 | 0.01953 | 0.577810651 | 1.165466407 | 62.09606254 |
| 103 | Comp-17 | 0.03418 | 1.011242604 | 1.319409401 | 91.29927615 |
| 104 | Comp-19 | 0.0293 | 0.866863905 | 1.257741027 | 87.65632044 |
| 105 | Comp-21 | 0.03174 | 0.939053254 | 1.302199372 | 81.08728952 |
| 106 | Comp-23 | 0.02441 | 0.722189349 | 1.214990312 | 87.29782327 |
| 107 | Comp-25 | 0.02686 | 0.794674556 | 1.213411727 | 55.02037234 |
| 108 | Comp-27 | 0.03906 | 1.155621302 | 1.344900662 | 67.95517864 |
| 109 | Comp-29 | 0.03662 | 1.083431953 | 1.283853965 | 48.05825631 |
| 110 | Comp-31 | 0.04882 | 1.444378698 | 1.468162639 | 83.01775581 |
| 111 | | | | | |
| 112 | #352 PENNZOIL 15W-40 MOTORED 1500 RPM | | | | |
| 113 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 114 | Comp-2 | 0.03418 | 1.071473354 | 1.316071759 | 82.1694452 |
| 115 | Comp-4 | 0.03174 | 0.994984326 | 1.266409266 | 53.48879926 |
| 116 | Comp-6 | 0.06348 | 1.989968652 | 1.430168733 | 32.37596893 |
| 117 | Comp-8 | 0.03907 | 1.22476489 | 1.319826457 | 47.33251526 |
| 118 | Comp-10 | 0.03662 | 1.147962382 | 1.285625146 | 45.21103297 |
| 119 | Comp-12 | 0.06836 | 2.142946708 | 1.617915574 | 47.97747198 |
| 120 | Comp-16 | 0.01953 | 0.612225705 | 1.165634806 | 59.15544913 |
| 121 | Comp-18 | 0.01221 | 0.382758621 | 1.103553558 | 48.13383695 |
| 122 | Comp-22 | 0.05371 | 1.68369906 | 1.528693769 | 72.00892202 |
| 123 | | | | | |
| 124 | #353 PENNZOIL 15W40 MOTORED 2000 RPM | | | | |
| 125 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 126 | Comp-6 | 0.01709 | 0.535736677 | 1.147696828 | 50.46155938 |
| 127 | Comp-8 | 0.04395 | 1.377742947 | 1.417616876 | 60.39905607 |
| 128 | Comp-10 | 0.03174 | 0.994984326 | 1.360149779 | 91.70007255 |
| 129 | Comp-12 | 0.026851 | 0.841724138 | 1.281224144 | 73.67207876 |
| 130 | Comp-14 | 0.06591 | 2.066144201 | 1.534419849 | 57.48602787 |
| 131 | Comp-16 | 0.01953 | 0.612225705 | 1.170567686 | 58.27164738 |
| 132 | Comp-18 | 0.03906 | 1.224451411 | 1.348718864 | 69.6925202 |
| 133 | Comp-20 | 0.00244 | 0.076489028 | 1.020774798 | 57.25309136 |
| 134 | Comp-22 | 0.031737 | 0.994890282 | 1.374067395 | 115.6215797 |
| 135 | Comp-24 | 0.00977 | 0.306269592 | 1.091530823 | 67.17725261 |
| 136 | Comp-26 | 0.02197 | 0.688714734 | 1.183174921 | 53.20452206 |
| 137 | Comp-28 | 0.0415 | 1.300940439 | 1.374616357 | 71.24871605 |
| 138 | | | | | |
| 139 | #354 Pennzoil 15W40 Motored 2500 prm | | | | |
| 140 | Stroke/rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 141 | Comp-2 | 0.017089 | 0.535705329 | 1.184783902 | 60.77802268 |
| 142 | Comp-4 | 0.01953 | 0.612225705 | 1.193194183 | 69.01018694 |
| 143 | Comp-8 | 0.02686 | 0.84200627 | 1.230024835 | 46.17250612 |
| 144 | Comp-10 | 0.01953 | 0.612225705 | 1.173046252 | 42.86565515 |
| 145 | Comp-12 | 0.043943 | 1.377523511 | 1.445682932 | 59.50659887 |
| 146 | Comp-18 | 0.04151 | 1.301253918 | 1.374470005 | 46.98589301 |

| | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|
| 147 | Comp-20 | 0.03174 | 0.994984326 | 1.279204785 | 51.31943194 |
| 148 | Comp-26 | 0.03662 | 1.147962382 | 1.395250944 | 60.93360063 |
| 149 | Comp-32 | 0.034183 | 1.071567398 | 1.350390028 | 90.91149588 |
| 150 | | | | | |
| 151 | **#401 Pennzoil SAE30 Motored 1000 rpm** | | | | |
| 152 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 153 | Comp-2 | 0.06338 | 1.986833856 | 1.485670498 | 28.37748013 |
| 154 | Comp-4 | 0.09033 | 2.831661442 | 1.790081343 | 42.31268023 |
| 155 | Comp-6 | 0.04883 | 1.530721003 | 1.387078874 | 29.09906213 |
| 156 | Comp-8 | 0.04883 | 1.530721003 | 1.389456054 | 26.54871994 |
| 157 | Comp-10 | 0.0415 | 1.300940439 | 1.330993779 | 22.46890578 |
| 158 | Comp-12 | 0.04885 | 1.531347962 | 1.35380604 | 29.96703998 |
| 159 | Comp-14 | 0.05615 | 1.760188088 | 1.432422025 | 28.60967833 |
| 160 | | | | | |
| 161 | **#402 Pennzoil SAE30 Motored 1500 rpm** | | | | |
| 162 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 163 | Comp-1 | 0.04151 | 1.301253918 | 1.342576545 | 40.83479479 |
| 164 | Comp-3 | 0.0415 | 1.300940439 | 1.354791827 | 43.28716326 |
| 165 | Comp-5 | 0.03906 | 1.224451411 | 1.326179541 | 52.79164482 |
| 166 | Comp-7 | 0.05127 | 1.607210031 | 1.494550014 | 50.29022931 |
| 167 | Comp-9 | 0.02442 | 0.765517241 | 1.213592233 | 58.00546259 |
| 168 | Comp-11 | 0.02197 | 0.688714734 | 1.166767876 | 41.08754158 |
| 169 | Comp-13 | 0.0708 | 2.219435737 | 1.682146642 | 55.55877083 |
| 170 | Comp-15 | 0.06103 | 1.913166144 | 1.525894011 | 48.47972678 |
| 171 | Comp-17 | 0.068363 | 2.143040752 | 1.720012217 | 74.24990881 |
| 172 | Comp-19 | 0.04395 | 1.377742947 | 1.410632533 | 77.17049993 |
| 173 | Comp-21 | 0.02441 | 0.765203762 | 1.185627376 | 32.88280965 |
| 174 | | | | | |
| 175 | **#403 Pennzoil SAE30 Motored 2000 rpm** | | | | |
| 176 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 177 | Comp-1 | 0.05615 | 1.760188088 | 1.464126302 | 50.01180544 |
| 178 | Comp-3 | 0.03906 | 1.224451411 | 1.373351176 | 61.47305956 |
| 179 | Comp-5 | 0.03906 | 1.224451411 | 1.293529721 | 41.19797563 |
| 180 | Comp-7 | 0.03417 | 1.071159875 | 1.290141802 | 52.15515701 |
| 181 | Comp-9 | 0.03173 | 0.994670846 | 1.244302433 | 46.13753945 |
| 182 | Comp-11 | 0.02685 | 0.84169279 | 1.191416554 | 39.55572924 |
| 183 | Comp-13 | 0.03906 | 1.224451411 | 1.29979277 | 45.32514692 |
| 184 | Comp-15 | 0.02929 | 0.918181818 | 1.256884757 | 46.35987544 |
| 185 | Comp-17 | 0.03418 | 1.071473354 | 1.270689792 | 36.89484301 |
| 186 | Comp-19 | 0.04638 | 1.453918495 | 1.350964813 | 36.85554679 |
| 187 | Comp-21 | 0.02685 | 0.84169279 | 1.200897868 | 40.91007953 |
| 188 | Comp-23 | 0.07295 | 2.286833856 | 1.521220349 | 30.76780158 |
| 189 | Comp-25 | 0.03174 | 0.994984326 | 1.264632316 | 41.74104002 |
| 190 | | | | | |
| 191 | **#404 Pennzoil SAE30 Motored 2500 rpm** | | | | |
| 192 | Stroke/Rev | Delta2(Volts) | Delta2(μm) | Gamma2 | 1/OLY# |
| 193 | Comp-2 | 0.01709 | 0.535736677 | 1.136327377 | 49.80649664 |
| 194 | Comp-4 | 0.02685 | 0.84169279 | 1.172214739 | 30.43596709 |
| 195 | Comp-6 | 0.03662 | 1.147962382 | 1.305192099 | 53.68445619 |
| 196 | Comp-10 | 0.04151 | 1.301253918 | 1.306279053 | 30.36033096 |
| 197 | Comp-12 | 0.02686 | 0.84200627 | 1.180365297 | 32.0813602 |
| 198 | Comp-20 | 0.0293 | 0.918495298 | 1.21026193 | 28.96302367 |
| 199 | Comp-22 | 0.02929 | 0.918181818 | 1.220192452 | 34.88100541 |
| 200 | Comp-26 | 0.04882 | 1.530407524 | 1.366076785 | 32.97453286 |
| 201 | Comp-30 | 0.02197 | 0.688714734 | 1.157739805 | 30.29360822 |
| 202 | Comp-32 | 0.05615 | 1.760188088 | 1.449991986 | 45.69501938 |

Olechowski
Analysis of single and multi-grade lubricant film thickness in a diesel engine.

Thesis
0395
c.1

Olechowski
Analysis of single and multi-grade lubricant film thickness in a diesel engine.